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I.—*Catalogue of the Birds of the Peninsula of India, arranged according to the modern system of Classification; with brief Notes on their Habits and Geographical Distribution, and description of new, doubtful and imperfectly described Species:—By* T. C. Jerdon, *Assistant Surgeon, 2d Madras Light Cavalry.*

(Continued from No. 26 *page* 80.*)*

Tribe SCANSORES.

Family PSITTACIDÆ.—*Parrots.*

Sub Family MACROCERCINÆ.—*Long tailed Parrots.*

Genus PALÆORNIS.—*Ringed Parrakeet.*

200.—*P. torquatus*, Vigors.—*P. cubicularis*, Wagler.—*Ps. torquatus*, Gmel.—*P docilis*, Vieill.—Perhaps also *P. bicollaris* of the same—*Lybur Totah*, or *Totah*, H.— *Common red-ringed Parrakeet.*

This parrot is one of the most common and abundant birds in India, frequenting the cultivated ground and gardens in all parts of the country, even the most bare and open. It is very destructive to various

kinds of grain and fruit. It associates in flocks of various size, sometimes very numerous, roosting in the holes of old trees, and flying forth to their various feeding haunts, early in the morning. When the grains are cut and fruit is scarce, it often takes long flights in search of any fruit-bearing trees, skimming close to the large trees, and when successful in its search, in general not alighting suddenly, but taking a short circle, and changing its usual mode of flight, viz. a swift and continued flapping of their wings, to a steady sailing with wings spread and turned obliquely downwards, and thus alighting on the tree speedily commences its meal. Its flight is very swift, and it generally keeps up a harsh scream when in motion. It is, however, at all times a noisy bird. It breeds in holes of trees during the hot weather, laying, as I am credibly informed, 3 or 4 white eggs.

Irides light yellow; bill lively red above, dusky beneath. Length 16 to 18 inches; wing 7; tail 10 to 11.

201.—*P. Alexandri*, Vig.—*Psitt. Alexandri*, Auct.—*Raee-Totah*, H. —*Large red-ringed Parrakeet.*

This species is much more rare than the last, and I have only seen it on two or three occasions. The first time I became aware of its being found in the peninsula was seeing one carried off in an open space in the jungles of Malabar by a Shaheer *(Falco Aldrovandi)*, which dropped it on my firing at it, and I picked it up, severely wounded but still alive. I have again seen it once or twice in the neighbourhood of well wooded villages, in the northern part of the table land, and obtained 4 young ones from the nest, in a hole of a lofty tree, last December. As I am informed by shikarees that it is not very uncommon in some of the more wooded districts, I dare say I have occasionally overlooked it, mistaking it for the last; still it is comparatively so rare, that I think the previous species was most probably the one taken first to Europe from this country, and which therefore should have been named *P. Alexandri*. It breeds during the cold season.

Length about 20 inches; wing 8½; tail 12; bill deep cherry red above, lighter and more orange red beneath; feet cinerous.

202.—*P. Bengalensis*, Vigors.—*Psitt. Bengalensis*, Gmel.—*P. erythrocephalus*, Gmel.—*P. flavicollaris*, Frankl.—*Yellow collared Parakeet*, Lath. Young bird.—*Tooeeah Totah*, H.—*Red-headed ringed Parakeet.*

N° II

Palæornis Columboides

Drawn on Stone C.V. Kistnaraz | *Blue winged Parrakeet* | Printed by C.V. Kistnaraz

This lovely species is never found in the open country, being a denizen of open jungles, and also found in the clearer spaces of the denser jungles. I have seen it in Goomsoor; also brought from the jungles of the Tondiman's country in the Carnatic; on the west coast, not uncommon; and even occasionally in low jungly districts in the Deccan. It has the same habits as others of the genus. The *P. flavicollaris* of Franklin, or *plum-headed Parakeet* is always found in the same localities as the *red-headed Parakeet,* and is considered as the young bird by shikarees and others; so, though I have not seen the actual change, yet as the size and structure agree, I have no doubt that it is the same bird.

The three last species are frequently taken when young and caged, learning to repeat words and sentences with facility, and becoming very tame.

Irides light yellow; bill reddish yellow above, beneath blackish. Length 14; wing 5¼; tail 8 to 8½.

203.—*P. Columboides,* Vigors.—*P. Melanorhynchus,* Sykes—young bird.—*Muddun Gowr Totah,* H.—*Blue-winged Parrakeet.*

This very elegant and chastely coloured *Parrakeet* is found only in the dense and lofty forests of Malabar, as well below the ghauts as on them, attaining, as I have observed on the sides of the Neilgherries, a height of nearly 5000 feet. Its usual call is less harsh than that of the other species. I have not yet seen it domesticated. I have shot the *P. melanoryhnchus,* always in company with the others, and consider it as the young bird. Whether the adult female retains the black bill or not, I do not know, as the specimens with red bills shot by me were all male birds.

Like the other species it feeds on fruit and berries of various kinds.

Irides light yellow; feet cinerous; bill lively red above, dusky beneath. Length 15—16 inches; wing rather more than 5½; tail 8½ to 9.

Sub Family LORIANÆ.—Swains.

Genus PSITTACULUS.—Khul, Selby.—*Lorikeet—Dwarf Parrot.*

204.—*Ps. vernalis,* Swains.—*Bhora* or *Bhoāra,* H.—*Red-rumped Dwarf Parrot,* or *Lorikeet.*

I am convinced that Swainson was right in separating this species

from the allied one, *P. galgulus*, for I have shot many of both sexes, and seen numerous specimens, none of which showed any approach to the plumage of the other. I have found this species only in the more open spaces of the lofty jungles of the west coast. It is most numerous, I think, in Travancore, and the more southern portions; also at the foot of the Neilgherries. I did not observe it at any considerable elevation, but I see it is enumerated in Mr. Elliot's Catalogue, as found in the Southern Mahratta Country, but only during the rains. It is found in small flocks, and while feeding keeps up a continual feeble chirping. I am informed by a gentleman who was for some time in Malacca, that either this, or an allied species (perhaps the *P. galgulus*), was often domesticated there, and that it had the same custom of sleeping with its head downwards, which the *Colies* (*Gen. Colius*) are represented to have. I found in the stomach of several birds a soft pulpy vegetable mass with a few seeds.

Irides whitish yellow; bill and legs orange. Length about 6 inches; wing rather more than $3\frac{1}{2}$; tail $1\frac{3}{4}$.

Family PICIDÆ, Swains.—*Woodpeckers.*

Sub Family PICIANÆ, Swains.—*True Woodpeckers—Lulkurphor*, H.

Genus PICUS.—*Typical Woodpeckers.*

Sub Genus PICUS, Swains.

205—*P. Strictus*, Horsf. Lin., Trans. vol. xiii.—*P. Peraluimus*, Wagler.—*P. Goensis*, Auct. (bad description).—*Scarlet-backed Woodpecker.*

This handsome *Woodpecker* is found only in the dense and lofty forests of the west coast, occasionally seen below the ghauts, but most numerous on the more elevated wooded regions, and frequently seen on the summit of the Neilgherries, in the thick woods there. Its habits do not differ from those of others of the genus. The *Scarlet-backed*

Woodpecker appears to belong to the most typical group of woodpeckers, and is the only one of that group I have yet seen from the peninsula. It is apparently a slightly aberrant species, leading to *Hemicircus* by its short neck, and short and broad tail. The female is said by Horsfield (fid. Wagler) to differ from the male in having the feathers of the head and crest orange, instead of scarlet. The only female I procured, has the whole of the head and crest of a sooty black, each feather ended with a white drop at its termination. This, however, may have been a young bird. Irides yellow; bill blackish lead colour; feet plumbeous.

Length about 12 inches; wing 6; tail 3 inches; bill to front $1\frac{5}{10}$th, straight to gape $1\frac{8}{10}$th; breadth at base above $\frac{5}{10}$ths; anterior toe (without claw) $\frac{8}{10}$ths; versatile do. 1 inch.

The tale of this woodpecker differs from that of most others of the family, in having the 4 centre feathers equally elongated, and all exposed when the tail is closed, instead of the 2 centre ones only, as is the case in most other species. The ends of all four are very much worn, so that the barbs on either side extend a fifth of an inch beyond the shaft. Its head is very broad also, and the whole body indeed is remarkably thick and robust.

Sub Genus HEMICIRCUS Swains.

206.—*H? cordatus.*—New species ?—*Heart-spotted Woodpecker.*

Descr.—Male, forehead and head, interscapular region, back, and rump, shoulders, wing coverts, chin, throat, and stripe from lower mandible running below the ears, of a light whitish yellow; the feathers of the wing coverts with a black heart-shaped spot at their termination. Face, cheeks, long occipital crest, nape, scapulars, quills, upper and lower tail coverts, vent and tail, deep black. Beneath from throat to the vent, dull green. On the centre of the back is a brush of dark sap green feathers, rough and somewhat bristly, and some of them smeared with a viscid secretion. Bill bluish black, legs greenish black. Irides brownish red. Length nearly 6 inches; wing $3\frac{3}{4}$; tail $1\frac{4}{10}$ths; tarsus $\frac{7}{10}$ths; anterior external toe $\frac{5}{10}$ths; versatile toe nearly $\frac{6}{10}$ths; bill to front $\frac{6}{10}$ths, at gape $\frac{8}{10}$ths. The female differs from the male only in the forehead and head being black, the feathers tipped with very minute whitish spots. This very singular little woodpecker, which is undescribed in Wagler's Monograph of the genus, appears to belong to Swainson's sub-genus *Hemicircus*, by its

short and broad tail; short neck; large feet, and excessively long wings. Its crest is tolerably long and somewhat pointed, and when raised, from the smallness of the neck, gives a triangular appearance to the head. The body is thick and dumpy. Of what use the peculiar brush-like feathers of the back are, it would be difficult to conjecture. I have found this woodpecker in the forests of Malabar, and also seen it in the Wynaad. It is also enumerated in Mr. Elliot's Catalogue.

It is, however, a rare bird; I have temporarily named it "*Cordatus*" from the heart-shaped spots on the wing coverts.

Sub Genus DENDROCOPUS, Swains.

207.—*D. Mahrattensis.*—*P. Mahrattensis*, Auct.—*P. hæmasoma*, Wagler.—*Red-bellied Woodpecker.*

This is the most universally spread of all the peninsular species of woodpecker. I have seen it, though rarely, in the Carnatic; frequent on the wooded west coast, though not in the denser jungles; and even occasionally met with it in groves of trees in the bare Deccan. I have seen it, also, on the summit of the Neilgherries. I found it most abundant in the Wulliar jungle, in the gap of Coimbatoor.

Irides fine lake colour; bill and legs slaty. Length 7 to $7\frac{1}{2}$ inches; wing $3\frac{8}{10}$ths; tail $2\frac{1}{2}$; exterior front toe above $\frac{4}{10}$ths; versatile do. $\frac{5}{10}$ths; bill to front $\frac{8}{10}$ to $\frac{9}{10}$ths; at gape $1\frac{1}{10}$ to $1\frac{2}{10}$ths.

208.—*D. Elliotti.*—New species. ?—*Golden-headed Woodpecker.*

I extract from Mr. Elliot's notes the description of this woodpecker, never having met with it myself. I put it as a *Dendrocopus* with doubt. If new, it may be named in honour of Mr. Elliot, its discoverer.

Descr.—"above black; crest and wing coverts, bright golden; cheeks, black spot from the eye to the occiput, and another commencing from the nape, and spreading between the shoulders, white. Chin and lower cheeks white, with five black lines running down the throat, breast and belly also white, covered with longitudinal black spots; quills blackish brown with three transverse rows of round white spots; bill and feet black. Irides crimson. Lives in pairs in cocoa-nut trees, often three or four pairs on the same tree. Only seen in one locality."

209.—*D. Moluccensis.*—*Picus Moluccensis*, Lath.—*P. variegatus*, Lath. and Wagler.—*P. bicolor*, Gmel.—*P. Pygmæus*, Vigors. Proc. Zool. Soc. 1830.—*Small-spotted Woodpecker.*

This little woodpecker is found in the more open spaces of all the larger jungles, whether on the east coast as in Goomsoor, or in the Malabar coast, where it is far from being uncommon, and is even occasionally found in avenues and gardens. In Goomsoor I found it frequenting the bamboos, and its tapping on the hard branches of these trees caused a loud sound, heard to a great distance. It does not confine itself to the larger branches, hopping and climbing actively about the smaller twigs, and feeding on various small insects and larvæ.

Irides yellow, naked orbitar skin, pink colour. Length 5 inches; wing 3; tail $1\frac{1}{2}$; bill to front $\frac{5}{10}$ths; at gape nearly $\frac{7}{10}$ths.

I possess a specimen shot in the Wynaad, which differs from all other specimens of this bird, which I have seen (as well as from the colour of the bird well represented in Hardwicke's Illustrations) in the much darker colour of the head and back, which are almost black instead of a light sooty brown. It has also less white beneath, its bill appears to be somewhat larger, and its feet perhaps rather less, but it is so similar in other respects that I do not venture to separate it.

Genus MALACOLOPHUS, Swains.

Sub Genus BRACHYLOPHUS, Swains.

210.—*B. Squamatus.*—*P. Squamatus,* Vigors.—Gould's Cent. Him, Birds?—*P. dimidiatus,* of Gray and Hardwicke's Ill. I. Z? not of Temminck and Wagler.—*Scaly-bellied Woodpecker.*

Although there are some slight discrepancies between my specimens and the description and figure in Gould's Century of the *P. Squamatus,* I have little doubt but that they are identical. I have found the *scaly-bellied Woodpecker* only on the western coast in well wooded districts, from the close neighbourhood and level of the sea, to the summit of the Neilgherries, where it is tolerably abundant, both in the thick woods, and among the brushwood. It in general does not ascend high on trees, keeping to the lower branches, and I have on several occasions seen it alight on the ground. In the most perfect specimens I possess, the throat and breast are nearly entirely green, the indications of the scaly markings being faint and undecided, the belly and vent are greenish white, with the scalings of the feathers much more numerous and smaller than are represented in the plate of Gould's Century, and the spots on the tail are almost obsolete and of a greenish dusky tinge. There is also a black nuchal mark. Irides pink, surrounded by a white

circle; bill horny above, yellowish at the base and beneath; feet greenish slaty. Length nearly 12 inches; of wing $5\frac{2}{10}$ths; tail $3\frac{3}{4}$; bill to front $1\frac{2}{10}$ths; at gape $1\frac{6}{10}$ths.

In the female the head is black where it is red in the male.

211.—*B. mentalis.*—*Picus mentalis,* Temm. P. C. 384? (Griff. Cuv. p. 444).—*P. chlorolophus,* Vieill., Encyl. Meth., young bird?—*Red* and *Yellow-crested Woodpecker.*

The brief description in Griffith's Cuvier of the *P. mentalis* of Temminck, appears applicable to specimens I have obtained from the western coast, with the exception that the throat is *not* black.

It is a rare bird. I have only seen it on two or three occasions, solitary in thick forest jungle in Travancore and Malabar. It is also mentioned in Mr. Elliot's Catalogue. However I shall here add a brief description. Head and cheek stripe red, a short occipital crest of same colour terminated by bright yellow: plumage above bright green; beneath dull sap green; the feathers banded and spotted with white. Wings greenish, with a strong orange tinge; and the external barb of most of the quill feathers of a deep orange red, internally dusky, with white spots; tail unspotted black; bill slaty, greenish beneath; legs sap green. Irides reddish brown. Length 9—$9\frac{1}{2}$ inches; wing $4\frac{8}{10}$ths; tail $3\frac{2}{10}$ths; bill to front $\frac{8}{10}$ to $\frac{9}{10}$ths; at gape $1\frac{1}{10}$th.

One specimen, probably the female, differs in having the forehead and head green, instead of red, and wants the red cheek stripe. The *P. chlorolophus* of Vieillot is probably the young bird, or it may be the female. The colouring of this species somewhat resembles that of the *P. Nepalensis* of Gray, figured in Hardwicke's Ill. of Ind. Zool.

212.—*B. Bengalensis.*—*P. Bengalensis,* Auct.—*P. aurantius,* Auct. (bad description).—*P. nuchalis,* Wagler.—*Brach. hemipodius,* Swains.—*P. chrysonotus,* Lesson?—*Orange* and *black Woodpecker.*

This is perhaps the best known of all the peninsular species, and is found wherever there is plenty of wood or high jungle, and even in groves and gardens in the vicinity of well wooded towns, as I have seen in the Northern Circars and Carnatic. On the bare table land, I have not yet observed it, but it is tolerably plentiful on the west coast, and in the wooded regions on the summit of the ghauts. It is generally seen single or in pairs. From its extensive distribution over India, it would be advisable to change its local name, either to the structural name of Swainson, or the one lately proposed by Wagler.

Irides crimson; bill blackish; legs plumbeous. Length nearly 12 inches; wing $5\frac{1}{4}$; tail 3; bill to front $1\frac{3}{10}$ths; at gape $1\frac{6}{10}$ths.

BRITISH MUSEUM

Drawn on Transfer Paper by J. Dumphy.

Picus Hodgsonii.

Printed by W Winchester

Sub Genus HEMILOPHUS, Sw.

213.—*H. Hodgsonii.*—New species ?.—*Large white-backed Woodpecker.*

Descr.—Head, short thick crest, and stripe running from the base of the lower mandible, crimson; lower part of back, rump and middle belly white; rest of the plumage deep black; bill black; legs dark plumbeous.

Length 19½ inches; wing 9; tail 7½; tarsus 1½; bill to front 2 $\frac{3}{10}$ths; at gape 2 $\frac{8}{10}$ths; width at base ½ inch; the tail is much wedged; wing with 6th quill longest; 7th equal to the 4th.

This splendid Woodpecker, apparently undescribed, appears to approach in colour the *P. Javensis* of Horsfield, the *P. leucogaster* of Temm. and *P. pulverulentus* of the same, but differs according to their description by the accurate Wagler, as well in size, as in some markings, especially the white of the back, which the above named species want. It is second in size only to the lately discovered *Chilian* species (*P. imperialis* of Gould), being about equal to the *P. principalis* of America; and though inferior in typical attributes to the *P. Sultaneus* of Hodgson, is yet its superior in size. I have seen it but rarely in the most dense and lofty forest jungle, and being exceedingly wary, I did not procure a fresh specimen, but through the kindness of Mr. Vaughan, Circuit Judge at Tellicherry, I obtained a fine stuffed specimen. I have named it in honour of Mr. Hodgson, Resident at the Court of Nepal, whose name is too well known to require here any further encomium from me.

Sub Genus MEIGLYTES, Sw.

214.—*M. badius* ?—*P. badius*, Raffles.—*P. brachyurus*, Vieillot and Wagler.—*P. rufus* of Gray and Hardwicke, Ill. Ind. Zool. (not of Wagler and other authors).—*Bay Woodpecker.*

This curiously plumaged Woodpecker is a rare species in the peninsula. I have seen it in thick forest in the Wynaad, and also in an avenue in Malabar, in the close proximity of thick jungle. Mr. Elliot also met it in the Southern Mahratta Country, and in his notes says, "Is remarkable for the head being generally smeared, as also the scapulars and tail, probably from the gum of some tree."

Irides brown; bill blackish; legs slaty. Length about 10 inches; wing 4 $\frac{8}{10}$ths; tail 2 $\frac{6}{10}$ths; bill to front nearly $\frac{9}{10}$ths; at gape 1 $\frac{2}{10}$ths.

Sub Genus CHRYSONOTUS, Sw.

215.—*C. tiga.*—*P. tiga*, Horsf. and Wagler.—*C. tridactylus*, Sw.—*Crimson-backed Woodpecker.*

This very elegant Woodpecker is found in the forests of the western coast, both at a low level and as high as 5000 feet, at which height I have seen it on the Coonoor pass of the Neilgherries. The specimens shot below the ghauts are considerably smaller than those I obtained at a great elevation, which latter attained the size of *P. Shorii* of Vigors, though not differing in colour from the smaller ones.

Irides fine crimson; bill and legs dark slaty. Length varies from 9½ to nearly 12 inches; of one of the latter size the wing is 5½; tail nearly 4; bill to front 1 inch; at gape 1 $\frac{4}{10}$ths; of one 9½ inches; the bill to front is $\frac{8}{10}$ths; at gape 1 $\frac{1}{10}$th.

Sub Family BUCCOINÆ, Sw.

Genus BUCCO, L.—*Barbet.*

216.—*B. Indicus*, Lath.—*B. Philippennsis*, Gmel. P. E. 333.—*B. flavicollis*, Vieillot.—*B. rubricapillus*, Lath. (from Brown, Illust. pl. 14.)—*B. luteus*, Lesson, albino variety.—*Kut-Khora*, H—also *Tambayut* i. e. *Copper-smith*, which name it receives also from some European residents.—*Red-crescented Barbet.*

The *Copper-smith* is extremely common in all parts of the country, wherever there are a sufficiency of trees, inhabiting open spaces in the jungles (never in the denser portions), groves, avenues, and gardens; being very familiar, approaching close to houses, and sometimes perching on the house top. As far as I have observed, it does not climb like the woodpeckers, but when feeding, hops about the branches like a perching bird. Though I never detected this *Barbet* tapping like the woodpeckers, I have once or twice had good reason for supposing that it does so occasionally. The chief food of the *Copper-smith* is fruit of various kinds, sometimes insects. When not employed in feeding, it generally seats itself on the very top of a tree, and gives utterance to its monotonous call of '*took took took*' (as represented by Sykes), nodding its head at each call, first to one side and then to the other.

Irides lake red; bill black; legs red. Length 6½ inches; wing 3$\frac{2}{10}$ths; tail 1½; tarsus $\frac{7\frac{1}{2}}{10}$ths; bill at front nearly $\frac{7}{10}$ths; at gape 1 inch.

217.—*B. viridis*, Gmel.—*B. zeilanicus*, Lath.—Brown, Ill. Zool. pl. 15., Le Cabezon.—*Kettorea*, Vieillot.—*B. Lathamii*, Vieillot, Encly. Meth. —*B. caniceps*, Franklin, Cat.—*Kootoomra*, H. of some shikarees.—*Kootoorga*, Mahr.—*Kootur Kakee*, Can., all named from its call.—*Brown-headed Barbet.—Jungle Barbet.*

This *Barbet* is found throughout India, only in the higher jungles, and is therefore of course most abundant on the west coast, where it is found from the level of the sea to the top of the Neilgherries, where it is more abundant than in any other locality I have visited. There is a very remarkable variation in the size of this species, the largest specimens being found on the Neilgherries, and degenerating in size, as you approach the coast. From Mr. Elliot's notes I extract the following interesting observations—" Seldom seen on the wing ; but single birds heard on almost every tree, uttering their peculiar note which resembles the native (Canarese) name, being a continued *Kōoturr Kŏturrr*, or *K'turrr*. They continue to call for some minute at a time, and are heard throughout the day. On each side of the throat is a naked spot with skin wrinkled, which is probably contracted and expanded when the bird is calling." This bird does not climb like a woodpecker, and I never heard any tapping from the trees it frequents. Its most general food is fruits and berries, occasionally it eats various insects. Mr. Elliot says " one was shot picking at the flowers of a small tree."

Irides reddish brown; bill and legs pale horny brown.

Length varies from hardly 8 to 10 inches; of the largest one, the wing is $4\frac{1}{2}$; tail nearly 3; tarsus $1\frac{2}{10}$ths; and bill at gape $1\frac{8}{10}$ths. In the smallest, the bill is only $1\frac{2}{10}$ths ; wing 4 ; and tail $2\frac{1}{2}$ inches.

Genus YUNX.—L.

218.—*Y. torquilla ?.—Wryneck.*

Mr. Elliot obtained a single specimen of this bird, or a nearly allied species, in the middle of the month of April, in the Southern Mahratta Country. It was seated on the ground in the bed of a dry tank. I have never seen it, and add Mr. Elliot's description for the sake of comparison.

" Above of a beautiful speckled grey, with a broad irregular dark line from the crown to the middle of the back; so dark in parts as to appear almost like black spots. Cheeks and throat pale yellowish, with narrow transverse bars, which are also continued on the chin, which has a white ground. A dark broad line runs from the eye to the ear,

and another darker, narrower, and better defined down the side of the throat. Breast and upper belly white, with small triangular black spots; wing coverts have a yellowish tinge. The quills are barred with brown and isabella. Rump and tail speckled; the former with black longitudinal streaks, the latter with 3 darker, broad bands, and partially edged with black. Bill straight, round, pointed—legs shielded, of a greenish horn colour. Irides crimson.

Length nearly 7½ inches; tongue long as in the woodpeckers."

Family CERTHIADÆ.—*Creepers.*

Sub Family SITTINÆ.—*Nuthatches.*

Genus SITTA.—L.

219.—*S. castaneoventris*, Franklin, Cat.—*Chesnut-bellied Nuthatch.* I have hitherto seen this *Nuthatch* but on one occasion, which I shot in Goomsoor, in high forest jungle. I have, however, seen specimens shot at the top of the Guzzlehutty pass, in Mysore.

Length 5¼ inches; wing 3; tail 1½; tarsus $\frac{7}{10}$ths; bill at front $\frac{6\frac{1}{2}}{10}$ths; at gape $\frac{9}{10}$ths; bill black; legs plumbeous brown.

Genus DENDROPHILA, Sw.—*Social Nuthatch.*

220.—*D. frontalis.*—*Sitta frontalis*, Sw., Zool. Ill.—*S. velata*, Temm. P. C.—*Velvet-fronted blue Nuthatch.*

This lovely little Creeper is found in great abundance in the dense woods of the Neilgherries. I have seen it, though rarely, below the ghauts, also in thick forest jungle. It hunts, in general, in small parties of five or six; is very active and restless, creeping round the horizontal branches chiefly, and seeming to prefer the under side of the branches, and also running downwards. It feeds on various small insects, which it picks off the bark, but does not tap like the common *Nuthatch.*

Irides light yellow; bill orange. Length 5 inches; wing 3; tail 1½; bill to front $\frac{4}{10}$ths; at gape $\frac{8}{10}$ths; tarsus hardly $\frac{7}{10}$ths; hind toe without claw ½ an inch.

FAMILY CUCULIDÆ—*Cuckoos.*

SUB FAMILY CUCULINÆ, Sw.—*Parasitic Cuckoos.*

GENUS CUCULUS, L.

221.—*C. canorus*, L.—*Cuckoo* of Europe.

The European *Cuckoo*, said by Franklin to be so common in Bengal, is rarely met with south of N. lat. 20. Its well known note was frequently heard in Goomsoor. Colonel Sykes too mentions it as found, though rarely, in the Bombay Deccan, and I obtained a specimen of what, I conceive, may be the young of this bird, as far south as the Tapoor pass (N. lat. 11°), and have seen the same bird apparently once or twice in wild jungly districts on the table land. I add a brief description of my bird, as I am by no means certain that it is the same as the European *Cuckoo*.

Descr.—Above brownish cinereous, the feathers all edged with white; beneath white, transversely barred with dusky brown; bill blackish; yellow at base; legs, toes and claws yellow.

Length 14 inches; wing $8\frac{3}{4}$; tail 7; tarsus $\frac{8}{10}$ths; bill to front $\frac{7}{10}$ths; at gape 1 $\frac{2}{10}$ths. Should my bird prove to be a different species from the European *Cuckoo*, it is perhaps the *C. tenuirostris* of Lesson.

222.—*C. fugax*, Horsf.—*Bychan Cuckoo*, Lath.—*Koopuk*, H.—*Oopuk*, of some.—*Pipeeha* in Bengal from its note.—*Indian Cuckoo.*

The Indian *Cuckoo* is found all over the peninsula in the more wooded districts, not only in thick jungles but also in groves and gardens. It is very numerous in the thickly wooded western coast, and its loud, shrill crescendo notes, very similar to those of the *Koweel*, are heard in every avenue. It flies very like the *Shikra*, and it is frequently pursued by small birds, probably under that impression.

The *Koopuk* lives chiefly on fruit, especially the fig of the banian tree, occasionally, however, on caterpillars, and other soft insects. I extract the following from Mr. Elliot's notes regarding its peculiar cry: " The note is *whe-wheewa*, *whe-wheewa*, *whe-wheewa*, uttered 8 or 10 times, and sometimes oftener. The first syllables lower, gradually rising till the last become extremely loud and shrill."

The dark spots on the breast and belly of this bird, have the same character as those of the hawks, being longitudinal in the young bird, and becoming transverse with age.

Irides bright yellow; bill brown; yellowish at the base; gape, eyelids and feet, of a deep bright yellow. Length 13 inches; wing 8; tail 7 tarsus $\frac{9}{10}$ths; bill to front $\frac{8}{10}$ths; at gape 1 $\frac{2}{10}$ths.

223.—*C. Himalayanus*, Vigors. Gould's Cent. Him. Birds.—*C tenuirostris*, Gray and Hardwicke's Ill. Ind. Zool.—*Small Bay Cuckoo.*

This very elegantly marked *Cuckoo*, supposed to be confined to the Himalayan mountains, is found, though rarely, all over the peninsula, in thick forest jungle. I have observed it once or twice only, in Malabar, and in the Coonoor ghaut, but have seen specimens from Travancore, where it appears tolerably abundant, and also from the eastern range of ghauts, about the lat. of Madras. The stomach of the only specimen I shot, contained caterpillars.

Length a little more than 10 inches; wing 5; tail 5; tarsus $\frac{6}{10}$ths; bill to front $\frac{7}{10}$ths; at gape rather more than 1.

224.—*C. flavus*—Gmel., Lesson Traité p. 151?—*C. honoratus*?—*C. Sonneratii*?—*C. lugubris*, Horf.?.—*Powsya*, Mahr.—*Plaintive Cuckoo.*

Among the imperfect descriptions of authors it is often difficult to determine correctly many species, but when the changes of plumage of the bird are themselves considerable, the difficulties are greatly increased. Such is the case with regard to the bird I am now going to mention. The *Plaintive Cuckoo*, as it may be appropriately named, is an inhabitant of the western coast of the peninsula, and is found alike in thick jungle, and in the more open spaces, and even in gardens and avenues. Though I frequently heard it, I only obtained two specimens, and am indebted to Mr. Vaughan for the examination of a third. I have neither seen nor heard it in any of the other districts of the peninsula. It is found at all levels from that of the sea, to the top of the Neilgherries, about Coonoor and Kotagherry, where it is found in thick bushy ground. Like the other cuckoos it is found single or in pairs. It has a most sweet and plaintive note, which is often heard, and which sounds something like the last syllable, being *whĕ-whēw*, *whe-whē-ē-w*, much lengthened out, and very plaintive. I found its food to consist chiefly of caterpillars. I shall add a brief description of the three birds I have had the means of observing.

The first is entirely of a dark cinereous tint, with a strong gloss of green throughout; tail blackish, edged with rufous; quills beneath cinereous. A second specimen has the same glossy green colour above, with the exception of the rump (which is lighter cinereous without any green),

and the forehead, which also is nearly devoid of the green, chin and throat cinereous; breast darker do. banded with rufous and white; belly pale cinereous, faintly marked with pale rufous and white; under tail coverts white; tail black; the inner webs banded with white (except the 2 centre ones), and all tipt white.

Another specimen has the plumage above entirely cinereous, with a slight indication of the greenish gloss on the wings only. Tail as in the last, beneath pale cinereous, vent and under tail coverts white, quills with a broad white band on their internal webs.

Irides, in one specimen (the last) of a fine ruby red. In the first one of a blood red, bill blackish red beneath (at the base), also at the gape and internally; feet reddish.

Whether this bird is identical with *Cuc. flavus* of Gmel. or a different species altogether, I leave to be decided hereafter.

Length 9 inches; wing $4\frac{1}{2}$; tail $4\frac{1}{2}$; tarsus $\frac{7}{10}$ths; bill to front $\frac{6}{10}$ths; at gape $\frac{9}{10}$ths.

225.—*C. dicruroides.*—*Pseudornis dicruroides*, Hodgson, Journal A. Soc. of Bengal, No. 86. p. 136.—*Drongo Cuckoo, or Black fork-tailed Cuckoo.*

This most extraordinary species of *Cuckoo*, disguised so effectually in the garb of the common *King Crow* (*Dicrurus*), has been lately described and figured by Mr. Hodgson, in the Journal of the Asiatic Society of Bengal. I obtained a single specimen in the Wynaad, near Manantoddy, and never again observed it. As Mr. Hodgson's paper may not have been seen by some of the readers of this Journal, I add his description—"Black with a changeable blue or green gloss—inner wing and tail coverts, and pair of extreme tail feathers, cross-barred with white. An oblique white bar across the wings internally, and high up. Bill black. Irides hoary brown; palate red. Legs and feet blue, 10 to $10\frac{1}{2}$ inches long; bill 1 $\frac{1}{10}$ th; tail $5\frac{1}{2}$ to $5\frac{3}{4}$; tarsus $\frac{1}{1}\frac{2}{6}$ths. Long anteal toe $\frac{1}{1}\frac{1}{6}$ths; long posteal do. $\frac{9}{10}$ths; weight $1\frac{1}{2}$ oz. Sexes alike, exclusively monticulous and a forester. Tail of 10 feathers divaricated and forked. The two extreme feathers smaller than any of the rest." Mr. Hodgson further says that "the *cuculus lugabris*, will I think, be found to have a forked-tail, and to constitute a second species of our proposed new genus."

I can only add to this, that in my specimen the legs were reddish, as in the last species, and that the wing is 5 $\frac{2}{10}$ths long. Irides also were reddish brown. I may mention that I had in my manuscript notes named this bird "*dicruroides*" or '*dicruricaudus*,' a name which its extraor-

dinary resemblance could hardly have failed to suggest, and which I was glad to see that Mr. Hodgson had also adopted. Does this *Dr ngo Cuckoo* select the nest of the *Dicrurus* to deposit its eggs in? If so, the foster parents would hardly be undeceived even when their progeny were arrived at maturity.

Genus OXYLOPHUS, Swains.—*Crested Cuckoo.*

226.—*O. edolius.*—*Cuc. edolius,* Auct.—*C. afer* and *C. serratus,* Gm.—*C. melanoleucos,* Gmel.?—*Leptosomus afer,* of Franklin and Sykes' Catalogues.—*Popeya,* H.—*Black* and *white-crested Cuckoo.*

The *Popeya* is distributed over all India, but cannot be said to be a common bird any where. It is of course most numerous in the more wooded districts. I have seen it in the Carnatic, Malabar Coast, and even on the bare Deccan, in low jungle or among gardens. It hunts single or in pairs, and feeds chiefly on various soft insects, &c. On the Neilgherries I have seen it occasionally about the edges of the hills, frequenting the thick bushy ground there.

Length 13 inches; wing $5\frac{1}{2}$; tail $6\frac{1}{2}$; tarsus 1 $\frac{1}{10}$th; bill to front $\frac{8}{10}$ths; at gape 1 $\frac{1}{10}$th.

227.—*O. Coromandus.*—*Cuc. Coromandus,* Lath.—*Cuc. Collaris,* Vieill.

I possess but one specimen of this bird, which I obtained alive at Madras, and have never seen another of the kind.

Genus EUDYNAMYS, Vigors and Horsf.—*Thick-billed Cuckoos.*

228.—*E. orientalis.*—*C. orientalis,* Lin.—*C. mindanensis* (the female), also according to Lesson.—*C. scolopaceus.*—*C. crassirostris.*—*C. punctatus* and *C. maculatus* of authors.—*Koweel,* H. Fem.—*Koreyala, i. e. spotted Koweel.*—*Koweel* of Europeans in India.—*Black Cuckoo.*

This well known bird is found in all parts of the peninsula, where there are a sufficiency of trees. It is common in the Carnatic in groves, gardens and avenues, and also in the west coast, but rare in the bare table land. It feeds entirely on fruit, and is remarkably fond of the fig of the banian tree. It has a most peculiarly shrill and piercing call of two syllables, repeated frequently, and every time with increased vigour, so that at the finale it is most piercingly loud. The *Koweel* (as is well known in India) lays its eggs in the nest of the common crow *(Corv. splendens),* from which it dislodges the crow's eggs. It is said always to choose this crow's nest. On one occasion I

obtained an egg from the female *Koweel*, it was of a dirty blue colour, marked with some dusky spots.* Irides fine blood red.

Length of male 15½; of female 16½; wing of latter 7¾; tail 7½; bill at gape 1 $\frac{4}{10}$ths.

GENUS XANCLOSTOMUS, SW.—MELIAS, LESS.—PHŒNICOPHAUS, Auct.

229.—*X. viridirostris.*—New species?—*Melias tristis*, Less.?—*Melias diardi*, Less.?—*Cuc. Sumatranus*, Raffles?—*Green-billed Cuckoo.*

I cannot find in Lesson or Cuvier a description of this *Cuckoo*, though that of the *Melias tristis* and *M. diardi* of Lesson, somewhat approaches it. It differs, however, in several particulars from either, and especially in size.

Descr.—Above blackish cinereous, with a tinge of green; wings and tail glossy green black, the latter tipped with white; beneath light greyish, with a tinge of fawn colour, and mixed with blackish on chin and throat.

Irides fine blood red; naked eye-spot cobalt blue; bill beautiful apple green; legs and feet greenish black. Length about 15 inches; of which tail is 10; wing 5¼; tarsus 1 $\frac{3}{10}$ths; bill to front 1 inch; at gape 1 $\frac{3}{10}$ths.

The *Green-billed Cuckoo* is found over all the peninsula, but it is an uncommon bird, except in some few localities. I have seen it in thick bamboo jungles at the bottom of the Coonoor pass, in thick hedges and trees in the Carnatic; and in bushy jungle in the Deccan. It wanders about from tree to tree, or works its way through the thick hedges, and feeds on various large insects, such as grasshoppers, mantides and the like; also on caterpillars and other insects. It makes its way with great adroitness through the thick prickly hedges and bushes it delights to frequent.

230.—*X. Sirkee.*—*Eudynamys sirkee*, Gray and Hardwicke's Illlustrations of Ind. Zoology.—*Red-billed Cuckoo.*

I have seen this bird in bushy ground on the top of the Neilgherries, but in no other locality till I lately met with it in a hilly and low jungly district, near Jaulnah. It has the same wandering habits, and same kind of food as the last species.

Irides reddish brown; bill cherry red, yellowish at tip; feet plumbeous. Length 16 to 17 inches; wing 6¼; tail 9½; tarsis 1½; bill to

* This bird is said to be excellent eating.

front 1; at gape $1\frac{5}{10}$ths; feathers of head and neck with the shafts of the feathers black, glistening and bristly.

Genus CENTROPUS, Ill.—*Lark-heeled Cuckoo.*

231.—*C. Pyrrhopterus.*—*C. Philippensis*, Cuv.—*Corydonix pyrrhopterus*, Vieillot.—*Cen. bubutus*, Horsf.—*Mahooka*, H.— *Crow Pheasant* of Europeans of India.

The *Crow Pheasant* is a common and universally spread bird, frequenting wooded and cultivated grounds, in all parts, and found also in the more open spaces of thick jungles. It is often seen in thick hedges, also in woody nullahs, and in low bushy tracts. It feeds on the ground chiefly, walking and running with great facility, and picking up various large insects, centipedes, lizards, and even scorpions and small snakes. It may often be seen walking along the bank of a dry tank, a bund of a paddy-field, and being a remarkably slow and stupid bird, and of slow flight, it is occasionally run down, or even caught by the hand, in sufficiently open ground. A good shikra will also easily strike it down.

The *Mahooka* has a deep sonorous call, something like '*whoot, whoot, whoot*,' which is often heard in a thick bush or hedge, while the bird itself remains unseen.

Irides crimson red; bill and legs blackish. Length 19 to 20 inches; of which the tail is 10 to 11; wing $7\frac{1}{4}$; tarsus 2 inches; bill to front $1\frac{3}{10}$ths; at gape $1\frac{6}{10}$ths.

Tribe TENUIROSTRES.

Family CINNYRIDÆ.—*Sun birds.—honey eaters.*

Genus CINNYRIS, Cuv.—*Shukur-hora*, H. i. e. *Sugar-sucker.**

232.—*C. Mahrattensis.*—*Certh. Mahrattensis*, Shaw.—*Cinnyris orientalis*, Frankl.—*C. cyanæus*, Vieill.—*Certhia Asiatica*, Lath.—*C. currucaria*, Auct., Young male.—*Purple honey sucker.*

This appears to be the most generally spread of all the *Cinnyrides*, and is the only one I have met with in the bare table land. In the Carnatic it is less numerous, I think, than the two next species.

* Called *Humming birds* by Europeans in India.

I have lately (February) seen the nest of this pretty little bird close to a house in Jaulnah. It was commenced on a thick spider's web, by attaching to it various fragments of paper, cloth, straw, grass and other substances, till it had secured a firm hold of the twig to which the web adhered, and the nest suspended on this was then completed by adding other fragments of the same materials.

The hole is at one side, near the top, and has a slight projecting roof or awning over it. The female laid 2 eggs, of a greenish gray tinge, spotted with dusky. The first nest it made was accidentally destroyed after two eggs had been laid, and the couple immediately commenced building another, in a small tree at the other side of the door, and, as in the first instance, commenced their operations on a fragment of spider's web. They reared two young ones from this nest.

The *Purple Honey-Sucker* has a very feeble, but sweet, chirping note. It feeds like others of the genus, partly on the honey extracted from flowers, and partly on minute insects, flies, cicadariæ, &c. It occasionally hovers on the wing before a flower, while extracting the honey, but generally hops or flies rather among the smaller twigs. Occasionally I have seen it snap at an insect in the air. Whilst feeding it frequently opens and closes its wings. The *C. currucaria* is certainly the young male of this bird, the outline and structure are the same, and in Jaulnah it is of frequent occurrence, no other species of *Cinnyris* but the *purpuratus* being found here: besides I have specimens in which the change to the adult plumage is nearly completed. I shall add a very brief description to show its difference from the next species.

Plumage above, of a glossy steel blue; beneath glossy purple; quills and tail black; plume of orange and yellow feather under the wing; bill and legs black. Length $4\frac{1}{2}$ inches; wing $2\frac{5}{10}$ths; tail $1\frac{1}{2}$; tarsus $\frac{6}{10}$ths; bill straight to front $\frac{7}{10}$ths.

Female, above greenish brown grey; beneath pale yellow; darkest on the throat; tail black; quills dusky.

I have seen this bird on the very top of the Neilgherries, which shews what a great degree of cold some of this tropical genus will suffer without inconvenience.

233.—*C. polita.*—*Certh. polita*, Lath.—Ois. Dor. pl., 11—*Certh. falcata*, Lath. ?—*Certh. purpurata*, Lath. ?—*Glossy green Honey-sucker.*

I have seen this very handsome bird in the Carnatic and west coast, where it is tolerably common, frequenting both gardens and jungles. Food and habits of the last.

Descr.—Above, glossy green; wings and tail dull black; throat and breast rich purple hue. A narrow bright maroon red collar intervenes between the rich purple of the breast and the dull blackish brown of the belly and vent; a tuft of orange and yellow feathers under the wing, as in the last; bill and legs black. Length $5\frac{1}{2}$ inches; of wing $2\frac{3}{10}$ths; tail $1\frac{6}{10}$ths; tarsus $\frac{6}{10}$ths; bill straight to front one inch. Female, above light greenish brown, quills darker; tail black; beneath pale yellow: only differs from the female of the last in the darker tint of the plumage above.

The male, though sometimes confounded with the last species, differs most conspicuously in the much longer and more arched bill, and the green play of colours in the upper plumage.

234.—*C. Sola*, Vieill. Ency. Meth. and Lesson.—*Certh. Zeylonica*, Lath.—*C. lepida*, Sykes' Cat.? not of other authors.—*Amethyst rumped Honey sucker.*

This species appears to be more abundant in the Carnatic than in any other part of the peninsula. In that district it is very common, and to be seen in almost every garden, flitting about from flower to flower, its brilliant hues every now and then displayed to the eye as it catches their reflection by the sun.

I presume that this is the *C. lepida* of Sykes' Catalogue, as that is an allied species, but the descriptions I have access to of that bird do not agree with this one, and moreover in Lesson's Traité the *C. lepida* is also mentioned as well as this species, and said to have been received from Amboyna. Nevertheless it may also be found in the west of India. Mr. Elliot says of this species "builds a hanging nest with an entrance near the top, opening downwards." I add a brief description: Male, head and angle of the wings glossy green; throat, neck, rump and upper tail coverts ameythystine; back and coverts, with narrow pectoral bar maroon red; beneath yellow, wings brown, quills edged with cinnamon; tail black, bill and legs do. Female, olive green above, beneath yellow, chin and throat white, wings and tail as in male. Length $4\frac{1}{2}$; wing $2\frac{3}{10}$ths; bill straight to point $\frac{5\frac{1}{2}}{10}$ths.

235.—*C. minima*, Sykes.—*Smallest Honey Sucker.*

This lovely plumaged little species I have only found but rarely in high forest jungle in Malabar. It is very much allied to the last in colouring, but differs, besides its smaller size, in the tint of the red on the back, which is much richer in this one; there is no green on the shoulders, the green of the head also is purer; and the quills are not

edged with cinnamon. Length $3\frac{3}{4}$; wing $1\frac{2}{10}$ths; bill straight to front $\frac{5}{10}$ths;

236.—*C. Vigorsii*, Sykes.

I have not been lucky enough as yet to fall in with this splendid species of *Cinnyris*.

Genus DICÆUM, Cuv.

237.—*D. concolor.*—New species?

Descr.—Above, brownish olive; beneath greenish white; wing and tail brown. Irides brown; bill and legs brownish cinereous. Length $4\frac{2}{10}$ths; wing $2\frac{1}{10}$ths; tail $1\frac{1}{10}$th; tarsus $\frac{1}{2}$ inch; bill straight to gape $\frac{1}{2}$ inch; to front $\frac{4}{10}$ths. Sexes alike.

This, if a true species of *Dicæum*, differs from its congeners in the plain and sober colours of its plumage. I have found it in the forests of Malabar, and also on the summit of the Neilgherries. It frequents the highest branches of lofty trees, hopping actively about the small twigs and flower branches, and feeding on various minute insects.

Sub Family PROMEROPIDÆ.

Genus UPUPA, L.—*Hoopoe.*

238.—*U. minor.*—*Hood-hood*, H., from its call.—*Hoopoe.*

The Indian *Hoopoe* is a tolerably common bird in every part of the peninsula of India; frequenting woody places, groves, single trees, hedges, and about old walls and other buildings; and to be seen in almost every garden. It feeds entirely on the ground, walking along with ease, and picking up various insects as it moves along.

The *Hood-hood* (a name which expresses its call much better than our English term) breeds, I am informed by shikarees, in the hot weather in holes of old walls and other buildings.

Tribe FISSIROSTRES.

Family MEROPIDÆ,

Genus MEROPS, L.—*Hurrial*, H.

239.—*M. Indicus.*—*Hurrial* and *Putringa*, H.—*Common Indian Bee eater*, often called by Europeans *Green flycatcher.*

This well known and common bird is spread in numbers over all India. It generally hunts like the true *flycatcher* from a fixed station, which is either on the top or upper branch of a high tree, or on the branch of a shrub or hedge, a bare pole, stalk of grain or grass, or some old building. Here it sits looking eagerly around, and on spying an insect, which it can do a long way off, flies off and captures it on the wing, with a distinct snap of its bill, and then returns to its perch, generally sailing slowly with outspread wings, the copper burnishing of its head and wings shining conspicuously in the sun beams. Sometimes it hunts alone, at other times in small parties, seated near each other; frequently it captures one or two insects before it returns to its perch; and in the morning and evening considerable numbers are often seen, sometimes in company with *swallows*, hawking actively about, and apparently catching many insects. The *bee-eater* also often changes its perch, taking up a fresh one at some distance. It has a peculiar loud, yet rather pleasant whistling note, which it often repeats in the mornings and evenings when gathered together. In the bare table land, the *Hurrial* generally retires to some secluded and jungly districts for the purpose of breeding, which it is said to do in holes in ravines. It sometimes picks an insect off the ground or off a flower or branch.

I have often seen this bird collect towards sunset in small parties on a road, and roll themselves about in the sand and dust, evidently with great pleasure.

Length to end of lateral tail feather $7\frac{1}{2}$; of wing $3\frac{7}{10}$ths; tail $2\frac{8}{10}$ths; two central tail feathers beyond $2\frac{1}{4}$; bill to front $1\frac{2}{10}$ths.

240.—*M. Philippinus*, Auct. P. E. 57.—*Blue-tailed bee-eater.*

This bird, by no means common any where, is rarely met with in the Carnatic or table land, and only, I think, in the cold weather. It prefers a well wooded country, and I have seen it in Goomsoor in open parts of the jungle, and in the west coast occasionally in similar situations. It is almost always found in small parties seated on the tops of high trees, frequently among wet paddy-fields, and in general perhaps, making a much longer circuit than the last one, capturing several insects before returning to its perch. I have on one or two occasions seen it perched on a low palisade overhanging some water, and every now and then picking an insect off the surface of the water. I once saw an immense flock of them at Caroor, in the Carnatic (Coimbatoor district) and in the beginning of March. There were many thousands of them perched on the lofty trees lining the road there, which occa-

sionally sallied forth for half an hour or so, making a great circuit before returning. These birds were most probably what had been spread over great part of that country, now collected to migrate into a more wooded region, during the approaching hot season when insect life is scarce.

Like the last, this has a loud and pleasing sort of whistle, more full and mellow than that of its more common congener.

Length to end of lateral tail feathers 9½ inches; two central feathers beyond 2 inches; of wing 5¼; tail 3¾; bill to front 1½.

241.—*M. quinticoler*, Vieillot, Encyl. Method. p. 393.—*Chestnut-headed bee-eater.*

I have only seen this bird on two occasions, once at the foot of the Coonoor pass in dense jungle, and again in an open forest on the Malabar Coast. It pursued insects from a fixed perch, returning after having captured one—was generally seated on a low bough, solitary, or two or three together. Irides fine red.

Length 9 inches; wing 4 $\frac{3}{10}$ths; tail 3¼; bill to front 1 $\frac{3}{10}$ths.

There is no *elongation* of the central tail feathers.

242.—*M.? cyano-gularis.*—New species?.—*Nyctiornis?.*—*Blue-throated bee-eater.*

Descr.—A broad blue stripe extends from the base of the lower mandible down the throat and breast; upper part of the body, the head and tail, green, with a bluish tinge; belly of a buff colour, with dashes of green; eye, bright scarlet; bill and feet brownish black.

Length 14 inches; wing 5½; tail 6; tarsus ½ inch; bill 1¾.

I have two or three times observed this fine species of *bee-eater* at the foot of the Coonoor pass of the Neilgherries, in dense and lofty jungle. One time it was alone, the other times I observed it in pairs, perching on the tops of the highest trees, and flying before you from tree to tree. I was not fortunate enough to obtain a specimen, owing to their extreme wariness, but was kindly allowed to inspect and examine a specimen procured by M. Delessert. I suspect from the shortness of its wing that it is a *Nyctiornis* of Swainson.

Genus CORACIAS, L.—*Roller.*

243.—*C. Indica*, L.—*C. Bengalensis*, Steph.—*Cor. nœvia*, Vieill. and Less., Edwards pl. 326.—*Subzuk* and *Neelkond*, H., both words having reference to its colours.—*Tās*, Mahr. from its call.—*Indian Roller*, generally called *Jay* by Europeans.

The Indian *Roller* is of universal distribution throughout the country, as well in jungles as in the open country, there being few groves of trees near a village that do not harbour some. It generally takes its perch on the top or outermost branch of some lofty tree, and on spying an insect on the ground, which it can do at a very great distance, 40 or 50 yards and more, it flies direct to the spot, and generally seizes it on the ground, and then returns to the same tree and perch. A favourite perch of the *Roller* is a bowrie pole, or some bare leafless tree, by which it can command a larger range of view. It occasionally seats itself on a low bush, or even on the ground. I have on several occasions seen one pursue an insect in the air for some distance. It flies in general with a slow but continued flapping of its wings, but it has the habit of occasionally making sudden darts in the air in all directions. It has a harsh grating cry which it often utters on being disturbed. Its food is chiefly large insects, such as grasshoppers and their larvæ, caterpillars, mole-crickets, and even mice, which according to the shikarees are a certain bait for the *Subzuk*. I have frequently seen it caught by baiting with mole-crickets *(Gryllotalpæ)* placed at a great distance from its perch.

Irides dark red brown; bill brown; legs orange. Length 13½; wing 7¼; tail 5; tarsus 1; bill at gape 1 $\frac{7}{10}$ths.

Towards the north of the Deccan at Jaulnah, shikarees inform me that another kind of *Subzuk*, which they call the '*Pindareea Neelkund*,' makes its appearance for a short time during the commencement of the cold weather. Is this the *Eurystomus Orientalis* ?

Family HALCYONIDÆ.—*King-fishers.*

Genus HALCYON.—Sw.

Sub-Genus HALCYON.—Sw.

244.—*H. Smyrnensis.*—*Alc. Smyrnensis,* Auct.—*Kilkila,* H.—*White breasted King-fisher.*

This is the most common and generally spread of the Indian *King-fishers,* frequenting not only the banks of rivers and brooks, tanks, wells, and wet paddy-fields, but also dry cultivated ground, groves, old walls, and many other similar situations. It preys upon small fish, frogs, tadpoles and various water insects—also on small lizards, grasshoppers and various other large insects.

It has a very loud harsh rattling scream, generally uttered during flight. Is said to breed like the other *King-fishers* in holes on the banks of rivers. It is readily taken with a bait of a mole-cricket. Irides light brown; bill and legs red.

Length $11\frac{1}{2}$ inches; wing $4\frac{4}{10}$ths; tail $3\frac{1}{4}$; bill to front $2\frac{2}{10}$ths; at gape $2\frac{8}{10}$ths.

245.—*H. capensis.*—*Alc. capensis,* Auct.—*Malah-Poymah,* Mal. i. e. *Jungle King-fisher.*—*Large Jungle King-fisher.*

This large *King-fisher* is found wherever there is lofty jungle. I have seen it in Goomsoor, Malabar, and Travancore; also once lately in a well wooded brook in the northern part of the table land. It frequents brooks, rivers, and tanks, and, in the instances I have observed, always feeds on fish. Irides light brown; bill deep lake red; feet vermilion red.

Length 14 to 16 inches; wing $5\frac{5}{10}$ths; tail 4; bill to front 3 inches to $3\frac{3}{10}$; at gape $3\frac{6}{10}$ths to 4 inches.

Sub-Genus CEYX.

246.—*C. microsoma,* Burton, Proc. Zool. Soc. 1837?.—*C. purpureus,* Less.?—*C. tridactyla,* Sykes' Catalogue.—*Three-toed King-fisher.*

Not having obtained this little *King-fisher,* I have given the above names as synonymes with doubt. I have once or twice only observed this rare bird frequenting a tank in the northern part of the Deccan.

Genus ALCEDO.

Sub-Genus ALCEDO.

247.—*A. Bengalensis,* Gmel., Edw. pl. 11.—*Chota Kilkila,* H.

This species, so nearly allied to the European one, is common over all the peninsula, frequenting chiefly brooks and rivers, and feeding on small fish, and various aquatic insects. I possess a variety in which there is a good deal of white on the head, back of neck and back. In this one too the bill is entirely black. I may also remark that in some the shade of the plumage is bluish green, in others of a pure blue. Irides dark brown; bill black above; lower mandible orange; feet orange.

Length 7 inches; bill to front $1\frac{4}{10}$ths.

Sub-Genus ISPIDA, Sw.

248.—*I. rudis.*—*Al. rudis,* Auct.—*Koreyala Kilkila,* H.—*Black and white King-fisher.*

Common over all India, frequenting brooks, rivers and tanks. Unlike the other *King-fishers* which watch for their prey from a fixed station, and then dart down obliquely on it, the *spotted King-fisher* searches for its prey on the wing, hovering over a piece of water like some of the *Terns,* and then darting down perpendicularly on it. Irides hazel brown; bill and legs black.

Length 11 to 11½ inches; wing 5½; tail 2½; bill to front 2 $\frac{3}{10}$ths; at gape 2 $\frac{8}{10}$ths.

Family TROGONIDÆ.

Genus TROGON, L.

Sub-Genus HARPACTES, Sw.

249.—*H. Malabaricus,* Gould's Monograph?—*Trog. fasciatus,* Lath. —*Tro. Kasumba,* Raffles.—*Tr. Condea,* Temm. P. C.—*Koofnee Chooree,* H. of some shikarees.—*Kurna,* Mahr.—*Kakerne hukki,* Can.

This very richly plumaged *Trogon* is of rare occurrence in Southern India, and I have only found it in the densest portions of lofty jungle in Malabar and the Wynaad. It is, however, enumerated in Mr. Elliot's Catalogue. It is generally seen seated motionless on the branch of a tree, occasionally flying off to capture an insect, and sometimes, though rarely, returning to the same perch, generally taking up a new position, and wandering much about from tree to tree. I almost always observed it solitary—occasionally in pairs, and on one occasion four or five were seen together. In the stomach I have always found fragments of large coleopterous insects. The Hindoostanee name *Koofnee Chooree,* is given (says Mr. Elliot) " from its sitting with its head sunk in the shoulders, as if it had no neck, or as if dressed in a faqueer's '*koofnee.*' " Irides deep brown; bill and naked skin of fine deep cobalt blue; legs light blue.

Length 12 inches; of which the tail is above 6; bill straight to gape 1 inch.

The female differs from the male in wanting the black head and neck, which are of a light greenish brown. The belly is ochreous instead of

red, and the wing coverts are light ochreous brown, finely streaked with black, instead of black and white.

Family CAPRIMULGIDÆ.—*Night-jars.*

Genus CAPRIMULGUS, L.

Sub-Genus CAPRIMULGUS, Sw.

Chippuk, H. vulgo *Dubchooree* or *Dubhuk*—also *Undhe-chooree*, names given from its habit of squatting.

The species of this genus so much resemble one another that it is almost impossible to make them out from description alone, and I feel uncertain whether I am referring my specimens to their proper places. Four species have been described as inhabitants of the continent of India. I also possess what I consider four distinct species, and shall in the proper place describe the most essential points of difference between these four Indian *Night-hawks*, without reference to any others of the genus.

250.—*C. monticolus, Frankl.* Cat.

The only specimen of this species which I procured was immediately below the Ajunteh ghaut, in the low land of Candeish, so that the name of '*monticolus*' appears inappropriate to its habits in this part of the country, whatever they may be in Bengal. It differs remarkably from the other Indian *Caprimulgi* by the two external feathers of the tail being entirely white, tipped with mottled brown. The white marks in the four external quill feathers also are much larger than in any of the others.

Length of my specimen 10 inches; of wing which reaches to the end of the tail 8; tail $4\frac{1}{2}$; tarsus $\frac{7}{10}$ths.

251.—*C. Indicus*, Lath. ?—New species ?—*Neilgherry night-jar.*

I have temporarily placed this bird under the old name of *C. Indicus* of Latham, chiefly from the fact of its being feathered to the toes, as the *C. Indicus* is represented in the figure in Gray and Hardwicke's Illustrations of Indian Zoology. It differs, however, from the description and figure of that bird in having much less rufous tint, and being of a darker shade altogether, both above and beneath. This may depend

however, partly on age. I shall here give a brief description—plumage generally of a light cinereous, very much mottled with black and dusky, and in parts tinged with light fawn and cream colour; ears black, edged with light rufous; line below the ears extending along the gape, and throat spot, white. White marks on the four quills small. All the tail feathers, except the two centre ones, tipped with white, with a dusky margin. Wing not reaching to the end of tail which is long.

Length $11\frac{1}{2}$ inches; wing $7\frac{1}{2}$; tail $5\frac{6}{10}$ths; tarsus, feathered to the toes, not quite $\frac{6}{10}$ths.

Besides the differences above mentioned, the inner surface of the quills are represented in Hardwicke's drawing as being spotted on both sides with rufous white. In my specimen the external quill alone is spotted on the outer web only, and with very minute whitish marks.

I have only seen this *night-jar* on the summit of the Neilgherries, frequenting the stony hills, and during the day taking refuge in the woods.

252.—*C. Asiaticus*, Lath.?—*Small night-jar.*

The species which I shall for the present consider as the *C. Asiaticus* of Latham, is the smallest and most generally spread of all the Indian *night-jars.* I have found it in the Carnatic, west coast and Northern Circars, but not yet seen it on the table land, where, however, it was obtained by Col. Sykes. My specimens differ from the figure in Hardwicke's Illustrations, in wanting the black ear and sides of throat, but appears to resemble it much in other respects.

Length $8\frac{3}{4}$; of wing $5\frac{1}{2}$; tail $4\frac{1}{4}$; tarsus $\frac{7}{10}$ths.

253.—*C. Mahrattensis*, Sykes?—New Species?—*C. Asiaticus.*—var.?

This night-jar, which for the present I place under Col. Sykes' new species with doubt, very much resembles the last in the general distribution of the colours, but it is of a lighter tint throughout, and the rufous of the last is replaced in parts by a lighter or cream coloured hue. It much resembles the drawing of *C. Asiaticus* in Gray and Hardwicke, with which I suspect it is identical. It differs from Col. Sykes' description of his *Mahrattensis*, in having a sub-rufous or fawn coloured collar on the nape of the neck, and in the size and length of the tail, as given by Sykes, whose species, if these are permanent differences, is probably a different, though nearly allied bird, as it is stated by Sykes to have the two external tail feathers, only, tipped with white, like these two last ones, which after all I suspect may be perhaps but mere varieties, this one differing chiefly in size, and the lightness of

its plumage. In this case, however, there will still remain a fourth species, viz. Col. Sykes' '*Mahrattensis.*'

My specimens were found in the northern part of table land near Jaulnah. Length rather more than 9½; wing 6; tail 4½; tarsus nearly $\frac{8}{10}$ths.

All the species of the *night hawk* I observed have the habit, when roused in the day time, of flying a short distance, and then alighting on the ground and squatting close, not moving from the spot where they have first alighted. The note of the common one (No. 252), as well as of the Neilgherry species, both resemble the sound of a stone scudding over ice, or, as is well represented by Mr. Elliot, sound like the word *tyook, tyook, tyook.* Mr. Elliot in his notes states that he once found the eggs of the common species (two in number) placed on the ground without any nest. They were pink, spotted with brown.

Family HIRUNDINIDÆ.—*Swallows.*

Genus CYPSELUS, L.

Sub-genus CYPSELUS, Sw.

254.—*C. Alpinus,* Temm.—*H. Melba,* Auct.—*Large mountain Swift.*

As far as I can judge from descriptions, my bird is the same as the European one. I first observed it on the road between Madura and Palamcottah, when an innumerable flock passed over camp from the range of eastern ghauts, travelling towards the east coast. It was almost mid-day in the month of August. They kept a steady easterly direction. I afterwards saw in Travancore single birds, flying about at an immense height with great rapidity. I also saw them on the top of the Neilgherries, towards the edges of the hills, and also at Madura, flying in small parties every evening, just before sun-set, towards the east coast, apparently from the hills in the neighbourhood, as I did not see them during the day time. Its flight is amazingly rapid. Length 9 inches; wings beyond 2 inches; from flexure 8½; tail 3; bill straight to gape 1 inch.

255.—*C. affinis,* Hardwicke, Gray and Hardw. Ill. Ind. Zool.—*Ababeel,* H.—*White-rumped Swift.*

This species, though of general distribution throughout the peninsula, yet at the same time is so partially distributed as to have caused

Col. Sykes to say in his Catalogue "so rare in the Deccan that I have only obtained 2 specimens." It is found in all districts of India, but in these is often confined to a small tract in the neighbourhood of some few large pagodas, large old choultries, and other similar buildings. In the Carnatic it is common at Madras, at the rocky fort of Trichinopoly, and very numerous at the large pagodas of Madura, among which their nests are thickly crowded. On the west coast I saw it on several occasions, chiefly among rocky hills, but only observed it twice or thrice throughout the whole length of the table land from the Tapoor pass to Jaulnah, and then but few in number. At this latter place, however, it is very common, breeding in some old choultries and other buildings. It seldom, I think, takes a very long range from its breeding places. It builds its nest in company always, often thickly crowded together, placing them in corners and crevices of old buildings, and forming them of clay, profusely mixed with straw, grass, feathers and other soft substances, of which they appear externally to be entirely composed. During the night they roost in their nests, four or five often occupying the same one, as I observed in the celebrated choultry at Ajunteh.

The eye of this *Swift* is deeply seated, the eyebrow overarches it, and a ridge continuous with the eyebrow extends along the gape.

Length about $5\frac{1}{2}$; wing beyond $1\frac{1}{2}$; from flexure 5; tail $1\frac{6}{10}$ths.

256.—*C. palmarum*, Hardw., Gray and Hardw. Ill. I. Zool.—*Balassian Swift*, Lath.

This little species is common in all the districts of India, except on the bare table land, where it is rare. As its name implies, it frequents groves of palms, especially the palmyra *(Borassus flabelliformis)*, and does not in general fly to any distance from them. It is very abundant in the Carnatic. According to Hardwicke it builds its nest on the leaf of the palm.

Length $5\frac{1}{2}$; tail $2\frac{1}{2}$; wing $4\frac{1}{4}$. This bird is said in some works to be nocturnal. I need hardly add that such is not the case.

Genus MACROPTERYX, Sw.—*Swallow-tailed Swift.*

257.—*M. longipennis.*—*C. longipennis*, Temm. P. C. pl. 83.—*Hir. Klecho*, Horsf.—*Crested long-winged Swift.*

This very elegant *Swift* is only found in the South of India, in high forest jungle in the neighbourhood of hills. I have seen it in Goomsoor, at the foot of the Neilgherry hills, and in various parts of the

jungle of the western coast. It frequently perches on bare and leafless trees. While on the wing it has a somewhat loud parrot-like cry, very different from that of the other species.

Irides deep brown; bill black; legs bluish black; soles of feet reddish white. Length about 10 inches; wings 6; tail 5; 1¼ inch longer than the wings.

The female differs from the male in having black ears instead of rufous, and in having a white streak along the gape. The elegant frontal crest of this species is frequently raised when the bird is sitting.

Genus HIRUNDO, L.—*Swallow.*

258.—*H. Jewan*, Sykes.—*H. Javanica*, Lath.?—*Common Swallow.*

This is perhaps the most generally spread, and abundant of the Indian *Swallows*, being found in all parts of the country, frequenting both the neighbourhood of water, and open plains and gardens. It appears to differ but very slightly from the European swallow. I do not know if it breeds in this country, but think not; and it certainly disappears from some places during the hot season and monsoon. If it does not breed in the North of India, it probably spreads over the north of the Asiatic continent.

Length 7¼; wing 4¾; tail beyond 1 $\frac{4}{10}$ths; from base 4.

259.—*H. Erythropygia*, Sykes.—*Red-rumped Swallow.*

This *Swallow* in general, prefers the proximity of jungles. I saw it in Goomsoor, in the jungles round the Neilgherries (and also on the summit of the hills), in various other parts of the west coast, and in the Carnatic, at the Tapoor pass. In the northern part of the table land, however, I have seen it occasionally in the cold weather only, both in the neighbourhood of water and on dry open plains. It often is seen in the jungles it frequents, seated in great numbers on a tree. Mr. Elliot says of this species "flies after insects, and when its mouth is full sits on a tree to devour them." This bird varies a good deal in size. My specimens vary from 6 to 7½ inches long, of one of the latter the wing is 4½; and tail nearly 4.

260.—*H. filifera*, Stephens.—*H. filicaudata*, Frankl. Cat.—*Leishra*, H.—*Wire-tailed Swallow.*

This, by far the most elegant of its genus, is only found towards the more southern portion of the peninsula, about water. In the more

northern parts, however, it is more abundant, and generally spread, frequenting not only the neighbourhood of water, but also fields, gardens and open plains. It is found in small parties of 4, 6 or more. It breeds in holes of old walls and buildings, generally in the neighbourhood of water, also in wells and bowries, forming a small mud nest much open at the top. Its long tail feathers are only observable at a few yards distance, and in consequence of this, nine-tenths of Europeans here are unaware of its existence. It occasionally perches on trees.

Length to end of true tail 4½ to 4¾; of wings (1½ inch beyond tail) 4 $\frac{6}{10}$ths; tail 1½; long thread-like feathers beyond tail 5 inches; and more even.

261.—*H. concolor*, Sykes.—*Small black Swallow.*

I have never observed this plain coloured *Swallow* in the Carnatic, northern division, or west coast, and only towards the more northern portion of the Deccan. It is by no means numerous here—is solitary, frequents tanks and rivers, and also gardens, fields and villages. It breeds in the caves of houses, in high walls, and other buildings. Length to end of tail 4 $\frac{6}{10}$ths; of wings 4; tail 2.

262.—*H. Unicolor.*—New species.—*Hill Swallow.*

Descr.—Entirely of a glossy cinereous, or mouse brown; darkest on head, wings and tail, and with a tinge of green, and palest beneath.

Length 4¾; of wing 4½; beyond the tail 1 inch; tail 2; slightly forked and with the feathers very broad. The bill of this *Swallow* is much smaller than that of any of the Indian ones, and is also much hooked. It most closely resembles the *Cyp. palmarum* in colour. Tarsus $\frac{3\frac{1}{2}}{10}$th; feet very small.

I have only found this remarkable species on the Coonoor pass of the Neilgherries, and about the edges of the hills. It flies in large flocks, and with very great speed.

263.—*H. Sinensis*, Gray and Hard. Ill. I. Zool. ?.—New species ?—*River Martin* of India.

I know not if the little *Martin* I possess, be referable to the species above named or not, though I think it is probably distinct. I have only found it on one or two occasions in small parties, frequenting rivers, and breeding in holes in the river banks, during the month of December. I add a brief description.

Above of a light brown colour, lightest on the rump; wings and tail dark brown; chin, throat and breast, pale brown; belly, vent and under tail coverts, white.

Length $4\frac{1}{4}$ inches; wing $3\frac{1}{2}$; tail $1\frac{6}{10}$ths; wings reach $\frac{1}{2}$ an inch beyond tail, which is very slightly forked; tarsus $\frac{4}{10}$ths; bill to front $\frac{3}{20}$ths.

264.—*H. riparia*, L?.—New species?

This *Swallow* I venture to place (though with hesitation) under the European species, as I see it is enumerated in Franklin's Catalogue. It differs from the last named species, chiefly in its larger size, lighter coloured wings and tail, whitish throat, and in the rump being of the same shade of colour as the back.

Length $4\frac{3}{4}$; wing 4; tail 2; sligtly forked; tarsus hardly $\frac{4}{10}$ths; feathered on the back down to the hind toe.

I have hitherto only seen this species on one or two occasions in the neighbourhood of Jaulnah. It was on both occasions single, but flying in company with other swallows (*H. Jewan* and *H. filifera*) in the close neighbourhood of water.

II.—*Account of a Carboniferous Stratum at Baypoor near Calicut, Malabar Coast.—By Lieut.* T. J. Newbold, 23*d Light Infanty.*

In consequence of having observed some carbonaceous bits of clay in the bed of the river at Baypoor, a sea port town about 6 miles south from Calicut on the Malabar coast, in lat. north 10° 11′, and long. east 75° 53′, I took a canoe and proceeded up the river in order to examine the section of the strata, its northern bank afforded. It presented steep cliffs, varying from 20 to 40 feet in height, which, near the mouth of the river immediately below the traveller's bungalow, consisted of a gritty laterite; that further up the river passes into a horizontally stratified loose grit or sandstone; this often becomes compact and variegated with red and yellow bands. Beds of an ochreous yellow earth tend to loosen its structure, near which it assumes a friable, earthy, character.

Not far from the bungalow, underlying these beds at the foot of the cliffs, near the river bed, and washed by the tide at high water is a seam or stratum of carbonaceous shale, passing into a black clay from

the saline moisture to which it is continually exposed, and imbedding carbonized branches, leaves and trunks of trees. This bed varies from a few inches to five feet in thickness, dipping 4° towards the north-east, and can be traced about half a mile in an easterly direction up the northern bank of the river. It is intersected by deep, nearly vertical fissures, which are crossed in various directions by others more superficial. Its structure is obscurely laminar, and the more earthy portions of it glitter with minute micaceous particles. Other portions seem to consist wholly of carbonized woody matter, and have a tough elastic feel under the hammer. Its colour varies from a greenish black to a jet black. In two situations it imbedded numerous small shells, some of which had been reduced to fragments, and differing from the shells at present found in the river. The identification of these shells would probably afford an insight into the age of the laterite hitherto a desideratum in Indian geology. Should we feel disposed to refer the age of this carbonaceous deposit to that of the coal measures of Europe, the laterite here might be classed with the new red sandstone. The black shale and clay is highly impregnated with sulphate of alumina, and is somewhat analogous to the aluminiferous shale of the coal measures; and, like it, as before remarked, contains micaceous spangles disseminated. The surface and sides of the fissures are frequently coated with a yellowish efflorescence consisting chiefly of sulphur, iron and alumina: the two former of which appear to be in process of combination into the pyrites, usually seen in coal, rather than the result of decomposition from pyrites. The whole has a distinctly sulphureous odour. The carbonized branches, leaves and trunks of trees lay in a horizontal position in the black shale; from which, in consequence of their weathering less, they often projected where washed by the tide. The external longitudinal fibres and annular concentric delineations of some exogenous trunks were perfectly distinct. Some fragments were brown, heavy, tough, and woody; others brittle, with a brilliant fracture resembling a jet, light and bituminous; on some the thin bark was perfectly distinct, and exhibited in a beautiful manner the different stages of the carbonization of wood. Many fragments were penetrated with water, holding iron in solution, which had left on the surface a glittering reddish brown enduit.

The whole appearance of these strata, their situation and the horizontal position of the trees, leaves, and plants embedded in them, fully bear out the theory of the formation of our coal-fields and wealdens (viz. that they are the successive deposits of drifted trees, plants, clay and sand on the bed of a river or estuary) against the objections of a late

writer, Mr. Beaumont, who is of opinion that the coal vegetations grow and accumulate where they are found, on the surfaces of small islands, which have been subsequently submerged by the ocean. However, there appears to me to be no objection to the existence of both theories, if made applicable to the different conditions under which the coal-fields are found. The combination of iron, sulphur, and water in the deposits at Baypoor, has evidently afforded the principal chemical conditions for ligneous carbonization.

The following are the measurements of a section of the cliff and carboniferous stratum of Baypoor in a descending order:—

1st. 4 feet of sandy alluvial soil.

2nd. 10 feet of loose sandstone with beds of ochreous earth.

3rd. 20 feet of gritty sandstone, passing into gritty laterite, and variegated in its lower portions with red and yellow bands.

4th. carboniferous stratum varying from a few inches to five feet in thickness.

5th. level of the river.

The haste with which I was travelling prevented my examining the specimens as minutely as I could have wished; but the following results obtained by the blow-pipe will not be uninteresting. The leaves and stems of plants burnt slowly, with a faint flame of a bluish red tint, emitting a smell like that of coal, and leaving a reddish and whitish ash, the white appearing near the edges. This ash being submitted to the reducing flame, fused partially on its edges, exhibiting points of a greenish enamel, and others of a dark slag, attracted by the magnet. The black clay and shale, on the oxidizing flame, decrepitates, turns grey, and emits an odour of coal more or less distinct and sulphureous according to the predominance of earthy or carbonaceous matter in the specimen selected for examination. The change of colour exhibits the delicate fibres of plants in its structure, that were invisible previous to the application of heat. In the reducing flame it fuses into a light greenish grey enamel, or dark slag attracted by the magnet. The fibrous, heavy, carbonized wood burnt with scarcely any flame at all into a reddish cinder, giving out an odour, like that of burning coal. This finally fused, with slight gaseous extrication, into a black slag, powerfully attracted by the magnet. The yellowish sulphureous cauliflower-like efflorescence, before mentioned as encrusting the surface of the black shale, emitted distinct fumes of sulphur, and melted in the oxidizing flame, giving out numerous gaseous bubbles, into a dark cinnabar-red globule; which, on being exposed to strong

heat, was converted, with considerable diminution of bulk, into a black magnetic slag.*

I observed traces of a similar carbonaceous bed in the banks of the Tirtalla river in south Malabar, between Paulghaut and Calicut; and Colonel Cullen informed me, that he had discovered, so far back as 1832, a carboniferous seam, four or five feet thick in its broadest part, in a perpendicular cliff of laterite at Vorkully, a little south of Quilon. The cliff he described to me as about eighty feet high, facing the sea, and resting immediately on garnetiferous gneiss. The black aluminous shale and clay imbedding the carbonized wood was saturated with the moisture which percolated through the spongy substance of the superincumbent laterite. The specimens given me by Colonel Cullen, and for which I feel much indebted, assimilated in every respect those of Baypoor; except that the proportion of sulphureous matter was less in the former. Colonel Cullen also informed me that he observed some carbonaceous looking strata near Cannanore. It would seem therefore that their extent on the Malabar coast is considerable, and it is possible that they may be a continuation of one great deposit, or basin, the southern edge of which may be the stratum observed near Quilon, which Colonel Cullen states to be inclined at a considerable angle with the horizon. A few well conducted boring experiments made in favourable situations within this area, which is almost entirely occupied by the laterite, would serve to elucidate this point, and perhaps bring to light a more perfectly formed seam of coal. If so, its proximity to the coast and Bombay, and facilities of water carriage, would give it great advantages over the produce of the coal fields in the interior of Bengal.†

Colonel Cullen has accordingly favoured us with the following observations on his discoveries on the Western Coast, referred to in Mr. Newbold's paper.—Editor.

" I have no notes taken at the time, and I can only therefore now state generally from memory the appearances of these deposits.

" The deposit at Cannanore was examined very superficially. It consists exclusively of an aluminous clay or shale of a dark carbonaceous

* The carbonized wood with a shining fracture like jet, burnt into a light cinder with considerable flame.

† I have forwarded specimens of the Baypoor stratum for the museum of the Society, by sea from Cannanore.

colour, and was discovered accidentally, at the base of the laterite cliffs on the sea-shore at Cannanore, in February 1830. The cliffs are about fifty or sixty feet high. Their upper portion consists of the usual indurated dark red ferruginous clay; but, as the depth from the surface increases, the colours become greatly brighter and more variegated, and the clay soft and sectile and full of moisture; water in several places penetrating through the cliff. The aluminous or carbonaceous stratum is near the base of the cliff, and from the moisture it has a perfectly black appearance. I do not recollect any appearances of fossil vegetable matter—nor was I then aware of the Quilon deposits—and, being unwell, did not repeat my visit.

" The carboniferous deposit in Travancore, was pointed out to me in 1832, when on a visit. It is near the village of Vorkully, about fifteen miles S. of Quilon, and in the cliffs immediately on the sea-shore. The cliffs are here about eighty feet high, quite perpendicular, the upper portion consisting as usual of the indurated dark red laterite; gradually changing, as the depth from the surface increases, into bright and variegated colours, as at Cannanore. The carboniferous bed here is very conspicuous. It lies in an inclined position; the upper part of the bed about sixty feet from the top of the cliff, and the lower portion within five or six feet of its base, and easily accessible therefore. It was full of moisture, and water streamed from it. Above and below the bed, to the very base of the cliff, is composed exclusively of these variegated laterite clays. I do not think that the carboniferous stratum passed below the surface of the beach; if I recollect correctly, it terminated abruptly within five or six feet. It was quite insulated, and of a lenticular form, five or six feet thick at the most. The specimens of fossilized wood, both monocotyledonous and dicotyledonous, and the shale or clays of this stratum, have already been forwarded to the Society. I may add that the laterite in which these carboniferous beds have been discovered, appears to repose, as throughout Malabar, immediately on gneiss, masses of which appear in the sea, close to the cliff at Vorkully, and are to be found also in abundance within a few miles S. of the deposit at Cannanore."—W. C.

III.—*Note on the Geological position of the Laterite in the vicinity of Beder.*—*By Lieut.* T. J. Newbold, 23*d Light Infantry.*

In presenting to the Society an additional number of geological specimens from the Nizam's dominions, the Southern Mahratta Country, and the western ghauts, I have deemed it necessary to offer a few explanatory remarks on the geological *situs* of those collected in the vicinity of Beder. It was partly with the view of ascertaining the relative position of the laterite with regard to other rocks, that I was led to visit this ancient Mahomedan capital.

From the village of Cummumpilly, twenty-six miles E. S. E. from Beder, on the Hyderabad road, by Beder, to the western confines of the Nizam's dominions, the only rocks observed are the overlying trap, associated with amygdaloid, wacké, laterite, and a conglomerate formed from the *débris* of the laterite, with the exception of a narrow zone of grey limestone on the banks of the Bhima. The laterite is first seen resting as a bed, about 100 feet thick, on a trap hill, shaped like a truncated cone, near Sungum, about sixteen miles E. S. E. from Beder. Thence it continues capping the trap elevations with little interruption, forming the surface rock of the extensive table land on which the fortress and city of Beder stand. Here it rises in cliffs from 60 to 200 feet high, the trap appearing at their base, and continues capping most of the higher summits by Calliany to Gulberga; while the trap is seen forming the base of the plain and lower hills, to the bed of the Bhima. From this, across the frontier, the laterite and its conglomerate are occasionally observed in the Southern Mahratta Country, at Ingleswara, and in the vicinity of Bagwari and Belgaum, always overlying the trap on its associated wacké or amygdaloid.

The localities around Beder, where the best sections are afforded, exhibiting the superposition of the laterite on the trap, are some of its deeply sunk wells, and the base of the cliffs to the east, west and north. The rocks near their junction, are more or less blended together, which renders it difficult to draw a line of demarcation between the two. The trap is generally in a soft friable state, and the laterite abounding in lithomargic earth,—conditions, the explanation of which will be attempted elsewhere. The former rock, however, is little altered in one situation where it comes in contact with the laterite, viz. in the section afforded by the well, called the Begum's bourie, which lies a little to the S. E. of the mausoleum of the Mussulman Pir-zadeh, Shimilla Hussaini.

At the base of the cliffs west of Beder, veins of manganese, blended with iron ore, intersect the laterite near its contact with the trap, which appear to have penetrated from below. I am not aware whether the occurrence of similar veins in laterite has been previously noticed by geological observers. They were seen subsequently in the laterite of Ingleswara, and also in the sandstone near its contact with the trap, between Kulladghi and the falls of Gokauk. It is not improbable that the purple colour of the lithomarge, and that of the veins of amethystine quartz in the vicinity of Hyderabad, near which I detected manganese, may be owing to the presence of this mineral.

The soil on the surface of the elevated table land of Beder, is the result of the decay of the subjacent laterite, intersected by belts of black cotton soil. Voysey noted four well defined zones of this soil, running north and south, and lying between " ridges of iron clay," on the road from Beder to Shelapilly.

The laterite, as on the Malabar coast, is quarried at Beder, Calliany, and Belgaum, and extensively used for building. At Calliany shops and houses, now deserted, have been excavated in the solid rock; it is also employed, when ground into a clay with water, as a water-proof cement for the flat roofs of the houses in the last named town. The amygdaloid associated with the trap and laterite imbeds most of the minerals noticed in the great overlying trap formation of the Deccan, viz. calcedony, cornelian, semi and common opal, cacholong, calcspar, agate, jasper, heliotrope, a variety of zeolites, glauconite, olivine and augite.

IV.—*Geological Desiderata.—By* Lieut. T. J. Newbold, 23*d Light Infantry.*

1.—Observations on the direction of mountainous elevation throughout India, with reference to Elie de Beaumont's theory of the determination of the epoch of their *soulevement.*

2.—Connected and extended observations on the dip and direction of the stratified rocks, from the plains to the bases of uplifted abnormal masses. These observations should be continued on every side of the bases, and carried on in connexion with similar observations on the dip and direction of the joints and cleavage of rocks. The petrographical character of the rocks in all cases should be carefully noted. Little

attention has hitherto been paid to these important subjects by Indian geologists.

3.—Observations tending to elucidate the causes and conditions of the modifications of structure and morphic changes, remarkable in even continuous, and apparently homogeneous masses of both normal and abnormal rocks; and especially obvious near their line of contact with rocks of a different mineral character.

4.—Similar observations on basaltic dykes, and the rocks they pass through; noting the various amount of disturbance and alteration, with reference to the magnitude of the dyke. It will not escape the attention of observers that the basalt itself has been in some measure reciprocally acted upon by the rocks it penetrates. For instance,—the basalt passing through the clay-slate of the eastern ranges of the Ceded Districts, which is frequently converted into flinty slate or becomes crystalline and hornblendic, acquires a distinctly slaty structure, and so much modified in mineral character as scarcely to be distinguished from the altered clay-slate in its vicinity. In thin veins and near the edges of large dykes the basalt becomes compact; but towards the centre, where more slowly cooled, it is almost invariably of a crystalline, and sometimes of a porphyritic structure. Where basaltic dykes abound a general tendency to crystalline and metallic development will be remarked; as well, perhaps, as an increase in the deposition of saline and calcareous matter,—the sub-carbonate, muriate, and sulphate of soda. Those extensive depositions of nodular, tufaceous, travertine-like, and friable carbonate of lime,—the well known *kunkar* of India,—appear to have their origin from springs rising up from nearly vertical fissures in the subjacent rocks, which are invariably more numerous in the vicinity of great basaltic dykes, and have been caused, possibly, by the same disruptive forces that opened a vent to the basaltic matter with which many of the greater cracks are filled. A series of extensive observations incline me to the opinion that this basalt, and not granite, as generally thought by Indian geologists, is the lowest rock found in peninsular India, and that its development has a much greater influence over the direction and altitude of mountain chains than the usually supposed granite; which, though frequently observed with the uplifted schists resting on its shoulders, will, where opportunities of examination occur, be found to be merely an intermediate rock between the basalt and the normal rocks it underlies. It must not be forgotten in making comparative observations on the direction of the basaltic dykes, and on that of the mountain chain near which they occur, that we are most frequently doing so on branches merely from the main dyke, which diverge from it at various angles with its course, while the main dyke

is often concealed from view by the masses of rock it has uplifted. It is in the deep transverse valleys and clifts through ranges, and in low situations near their termination, in wells and other artificial or natural sections, that we are most likely to discover the true direction of the main dyke. To the *soulevement* of some of these branches may be attributed those low ranges of hills, called spurs, that often diverge at right angles from the direction of the principal chain.

5.—The calcareous deposits I have alluded to in No. 4, may be divided into two classes—ancient and modern. The latter, is still supposed to be in process of formation. Observations tending to show the various rates of progressive accumulation of the latter, and the rationale of its deposition under various conditions, would be instructive.

6.—Chemical analysis of the water in the springs and rivers of India during the dry and rainy seasons. From a careful examination of the latter an approximative idea might be obtained of the nature and quantity of calcareous and other matter, annually added from the land to the waters and bed of the ocean.

7.—There are large plateaus of sandstone on the summits of some of the ranges in the Ceded Districts, covered with ripple marks,—the general direction of which, and the slope of the country, show that the current of water that flowed over these beds anterior to their consolidation, must have had a south-easterly direction. I cannot call to mind that ripple marks have yet been noticed on the sandstone formations of India: but it is highly probable they do exist; and it would be desirable to search for them and note their direction, bearing in mind that the course of the great diluvial stream that flowed over these sands and clays, would be at right angles to the general direction of the ripple lines.

8.—From certain appearances near Nellore, Madras, Mavellipuram, and the present mouth of the Cauvery, it is certain that the sea in these particular localities on the Coromandel coast has advanced on and submerged considerable tracts of land; and two cities, according to tradition (at Mavellipuram and the ancient embouchure of the Cauvery), are now covered by the waves. The sea appears to be receding, or, more correctly speaking, the land appears to be rising in these particular localities. It is probable that, as on the Swedish coast, certain parts of the Coromandel coast, instead of participating in the progressive elevation of the land, suffer a lowering of level; while other portions remain stationary. I have observed similar indications of the sea having covered various parts of the Malabar, or western coast, to a considerable distance inland, in the existence of a former bed

of the ocean a few feet under the present surface of the ground, as we find it at Madras. The present town of Bararoor, north of Mangalore, and supposed by Rennell and Robertson to have been the Barace of ancient geographers, and which is now situated two or three miles from the mouth of the river, is traditionally said to have been situated close to the sea-shore, and its port frequented by large ships from all quarters of the globe; extensive tracts of marine sand and pelagic remains, a considerable distance inland, and the discovery of the hull of an antique vessel of considerable dimensions, and of a construction not known to the natives, buried in the earth, several miles inland near Cannanore, corroborate this tradition. Some of the Brahmins do not hesitate to assert that the whole of the coast was raised up from the bed of the ocean for their exclusive use.

Nothing but small native craft can now ascend the river to Bararoor, and its trade in consequence has been greatly diminished. The ancient town and fort of Calicut is said to have stood on a bank, now submerged by the sea, a little to the south of the present site. It would be desirable to mark and register the rocks now, as those on the shores of the Baltic have been done, at various places along both coasts, in order that the respective limits of these supposed undulatory movements may be traced satisfactorily at some future period.

9.—Observations on the terrestrial and marine deposits now accumulating at the estuaries of large rivers and backwaters, particularly in those of the Malabar coast, both as regards the way in which the accumulation takes place, the degree of mixture and relative proportion of the marine and terrestrial deposits, and the quantity annually deposited. Observations on the causes affecting alterations and shifting of the mouths of rivers would also be interesting.

10.—Investigations into the nature of the beautiful dendritic appearances observed between the layers of the laminar limestones and clay-slates of India, and those in the interior of moss stones, mocha stones and agates, usually attributed to metallic infiltration. A specimen of the Talicota limestone from the Rastia's territory exhibited appearances so strongly characteristic of the vegetable kingdom, as to induce me to send it to Dr. Wight, who kindly examined it, and stated his opinion of its being a species of fucus.

11.—Accounts of the geology of India, south of Madras to Cape Comorin.

12.—Boring experiments through the limestone and sandstone formations of Cuddapah and Kurnool, and through the carboniferous strata in the laterite near Quilon and Cannanore, discovered in 1832 by

Colonel Cullen, also through a similar formation at Baypoor near Calicut, and through the strata in favourable situations between these localities, which should be carefully examined for a continuation of the carboniferous bed or basin.

13.—A description of the geognostic position of the fossiliferous strata between Torioor and Womaloor, near Tattan about 10 miles south of the Pachamalley hills, with specimens.

14.—Do. of the magnesite formations of Yedichicolum, and other localities in the valley of the Cauvery.

15.—Do. of the corundum mines, in the same localities, principally at Veralimodos, near Sholasigámany, Cocarambady, in the Permutty taluk; also near Namcul. Mr. Fischer of Salem, informed me that he discovered a fine ruby imbedded in the corundum at Viralimodos, which was valued at forty pagodas. A description of these localities was expected from the able pen of the late lamented Dr. Benza, and it is to be hoped will be published by his executors, if not in print already.

16.—On a recent visit to the beryl mine of Pattaley, in the Kanghyum taluk, near Coimbatoor, I was informed by the natives that the beryl is also dug at a place called Vaniambady, at the northern base of the Neilgherries; farther information on this subject is desirable, as I cannot hear of this gem existing any where in Southern India except in these two localities. It may assist the observer in his search, to recollect that its matrix, both in Siberia and at Pattaley or Poddioor, is the cleavelandite.

17.—A description and specimens of a sulphuriferous soil, stated by the natives to occur in the Wodiapolliam jungle, south of Wolandoorpett, Southern Arcot, covering an extent of low swampy ground. Mr. Fischer, to whom specimens were sent, informed me that the sulphur is seen on the surface after rains in a yellowish crystalline form. He also kindly furnished me with a small quantity of the earth, which is friable and of a brown colour. The Wodiapolliam jungle he describes to be part of a jungly belt that extends, east and west, across the peninsula.

18.—The tracing of the sandstone and fossiliferous beds of Pondicherry, southward of the Gingee river. From the circumstance of specimens having been brought me by the natives, I think that the former, and possibly the latter with which it is associated, extends into the Verdachelum taluk of South Arcot, in a S. W. direction.

19.—A description of the extent, accompanied by a suite of specimens, of a bed of shell limestone, which I found between Hyderabad, and the city of Beder. This bed may be a continuation of a similar

one discovered by my friend Lieut. Wyndham, at Koolkunda and Digaye, between Muktul and Gulberga. I regret that severe illness prevented my examining these strata as minutely as I wished, and from procuring more satisfactory specimens than those I sent the Society, which are utterly insufficient for the purposes of classification. In both situations the shell limestone occurred at the southern edge of the great overlying trap formation of the Deccan, and considerably indurated; often passing into chert.

20.—An account of the rocks and deposits in the locality near Hingoli, in which the fossils lately discovered there occur. It is stated to have been found in the common dark coloured soil, but most probably has been transported there from some fossiliferous bed in the vicinity.

21.—Description of the magnesite bed in the vicinity of Hoonsoor, in Mysore.

22.—Farther observations on the laterite overlying the basalt, amygdaloid and wacké of the great trap formation of the Deccan.

V.—*A Brief Sketch of the Life and Writings of Father C. J.* Beschi *or* Viramamuni, *translated from the original Tamil.—By* A. Muttusami Pillei, *Manager of the College of Fort St. George and Moonshee to the Tamil translator to Government.*

Preface.

[The following sketch of the life of Father Beschi has been made from my original Tamil work, at the desire of Walter Elliot, Esq. to whom I am also indebted for many useful suggestions and hints regarding the matter of the work. I also feel grateful to the very Rev. Mr. P. E. Moriarty for his kindness in correcting a portion of the translation, and likewise to the Rev. Mr. W. Kelly, for much assistance of the same description.]

Translation.

In 1822, at the instance of Mr. Benjamin Guy Babington, and under the direction of Mr. Richard Clarke, I undertook to prepare a brief history of Father Beschi's life. Mr. Clarke is eminently skilled in both the dialects of the Tamil language, and was justly admired as one of the most distinguished ornaments of the Board of the Madras

Constantine Joseph Beschi

BRITISH MUSEUM
NATURAL HISTORY.

College. Mr. Babington possesses an extensive, and a profound knowledge of Sanscrit and Tamil. Immediately on his arrival in India, he eagerly applied himself to the acquisition of these languages, and made himself familiar with their genius and beauties, by his unremitting study of the historical and scientific works, that have been composed in these dialects. After having submitted to the College an English translation of the Shen Tamil Grammar, written originally in Latin by Father Beschi, he returned to England in possession of many of the works of that ingenious and distinguished writer. Some of these he has printed since his return to Europe, and he has transmitted them to Madras, that the memory of the venerable Father may be perpetuated and honoured in his adopted country. In executing the task, which under such auspices I willingly accepted, I availed myself of the manuscripts, which in 1798 had been prepared on the same subject by Viduvan Saminada Pillei, an excellent Tamil poet, and the author of many Tamil works.

In addition to the assistance derived from this source, I was in possession of many interesting and important facts regarding Father Beschi, which I gleaned during a tour through the south, from traditionary accounts, still preserved among the people.

My journey to the south was undertaken at the desire of Messrs. F. W. Ellis, the then senior member of the College Board, and A. D. Campbell, the present senior member, for the purpose of procuring a collection of Father Beschi's works, and I gladly embrace this opportunity to express my acknowledgment to these gentlemen for having confided to me a commission so honourable, and so congenial to my feelings. In truth, Mr. Campbell and Mr. Ellis are entitled to the gratitude of all, who take an interest in the preservation and spread of the oriental languages. They are the authors of many valuable oriental works. By their example and encouragement they have promoted the study of the native languages, and rescued these from the neglect into which they had fallen after the destruction of the Madura college. No longer sustained by that institution, which had flourished under the patronage of the ancient Pandyan kings, our vernacular languages creeping, if I may use the expression, as the vine without its support, would have rapidly degenerated, and sunk into a state of rudeness, had not the distinguished individuals whom I have just named, by their unremitting exertions, and the zealous co-operation of their colleagues, succeeded in establishing the Madras College, and thrown around it the light of their talents.

Fathers Beschi and Arnold were natives of Italy, and members of the illustrious Society of Jesuits. They received their education in the Roman College, where their learning and virtue attracted the admiration of the reigning Pontiff, who selected them, on account of their eminent qualifications, for the Eastern Missions.

They arrived at Goa in the year 1700. The Reverend Father Arnold proceeded to South Malabar, where he made himself perfect master of the Malayalam and Ariyam languages, in which he composed many admirable and valuable works, both in prose and verse, explanatory of the doctrines of the Christian Religion.

The Reverend Father Beschi was appointed to the south of the peninsula. On his arrival at his mission he applied himself with assiduity to the study of the Sanscrit, Telugu and Tamil languages, of which he became thoroughly master, particularly of the latter. As soon as he had acquired these languages he employed the best part of his time in removing the weeds, which unfortunately began to cover the fountain of the Christian faith; and, in order to preserve its holy purity, he laboured with indefatigable zeal to enlarge and circulate numerous Tamil works, explanatory of that creed, which had been composed by another extraordinary man, the Reverend Father Roberti Nobili. Mr. F. W. Ellis, Asiatic Researches vol. 14, page 58, says:— "I shall close this note by the translation of a passage from a work entitled, "*Tiru-schabeiyin Charítra Postagam,*" or "*Historia Ecclesiastica,*" written in *Tamul* and published by the *Protestant Missionaries,* at *Tranquebar*, in 1799. This passage is from the section relative to the transactions of the *Missionaries* in *India*, from the arrival of the *Portuguese*, at page 238 of the work, and under the year 1607. The work therein alluded to, as having been written in 1729, is by the famous *Jesuit Missionary* Constantio Josepho Beschi, known throughout the South of India for many valuable compositions in the high dialect of the *Tamul*, under the title of the *Vira-Māmuni or Dhairya Nātha-Swāmi.* This extract is from the preface to the *Vēda Viluccam, the Elucidation of the Scriptures.*"

TRANSLATION.

"[1607] At that time Roberti Nobili, called Tatwa-Bodhager, clothing himself in the habit of a Sanyasi, endeavoured to promulgate Christianity in this country. The secretary to the Congregation de Propaganda Fide, wrote in 1676 to Pope Innocent, that Roberti Nobili, although he called himself a Brahman, was not guilty of falsehood*."

* "The fact is that Roberti Nobili uses the word *Brahmana* always in the sense of priest, as indeed it is rendered though not with precision by Sir W. Jones in the Institutes of Menu; thus he calls the high priest of the Jews and his associates *Yúda-Brahmana*, and the father of the church *Bráhma-Vadigal.*"

He is represented with this habit and appearance in a picture in the convent of the 'paulist's at *Rome*, under which is the following inscription,—' "Father Roberti Nobili, a paulist of the city of *Rome*, and of an illustrious family; a godly and learned personage, who laboured to convert the heathens 45 years, eating nothing but rice and vegetables, and died happily at Mylapoor *(St. Thomé* near *Madras)* on the 16th January 1656." 'That which was written at *Yélacúrchi* (the principal residence of Beschi) in 1729 in his praise is as follows:—' "As the resplendent sun runneth his course in the firmament, but alloweth not his radiant face to be seen, so although St. Thomas, one of the twelve disciples of our Lord Jesus, and St. Xavier, far renowned for innumerable miracles, entered and preached the Gospel throughout this country, yet for a long time the darkness thereof was not dissipated. At last, as if the obscurity of the night, that elsewhere lowereth over all, had been dispelled by the rising of the sun, it pleased our Lord to turn his gracious eyes towards this country covered by paganism as by a cloud, and one hundred and twenty-two years past, to send hither orthodox priests to enlighten all souls. Tatwa-Bodhaca Swami, who then appeared steadfast in austere devotion, confirmed in the true faith, and perfect in virtue, was first sent by the Lord, and long resided here, bright as the morning star. Are not his *Cándam* (the *Jyána-bodhaca Cándam*) which, from soundness of religious doctrine, seems as if written in rays of light, and his other works, well known and received as a sun of everlasting brightness that hath never set. From that time to this, innumerable priests, devoted to their duty, have succeeded each other in succession, like an undivided garland."

Father Nobili had taken the title of Roman Brahman and was an incomparable Sanscrit pundit and poet. (His life and writings are about being published in a work, called the Hindoo Christian Observer). Father Beschi's anxiety was to produce abundant fruits on the tree of the Christian faith, which had been planted by St. Thomas the Apostle, and nourished by the zealous labours of St. Francis Xavier. Accordingly he defended the true faith from the attacks of its enemies, who viewed its prospering growth with envy, and exerted all his zeal to preserve it from decay. He spared no pains in composing luminous Tamil works, explaining the Christian faith. The rapid publication of these works, and the examples of all the various species of eloquence with which they abound, have stamped upon them a character of excellence, which every reader of them is anxious to admit. Although they were written above one hundred years ago, their language has undergone no change, not one word has become obsolete or suffered that

variation which the words of living languages constantly undergo. They are therefore entitled to the attention of all.

Father Beschi's next step was to study the works of the several eminent Hindu philosophers, devotees, ascetics, &c., such as those of Tiruvalluvar and others; and, after he had made himself perfectly acquainted with them, he began his ministry with that success which always accompanies a bold and popular eloquence. Instead of wasting his time in merely lopping the branches, he struck at the root of heathenism, and attacked the doctrines and disciplines of the several sects, with a vehemence peculiar to himself, but admirably suited to the temper and taste of the age. Long before his arrival, the Reverend Roberti Nobili composed many works, as above stated, which shook the science and philosophy of heathenism, and laid open to many of the Indians the imposture and absurdity of their established superstitions. Animated with an equal zeal, the Reverend Father Beschi boldly erected the standard of truth, and defended it with an unconquerable intrepidity.

From the time of his arrival in this country, he abstained from the use of flesh, fish, &c., and employed two Tamil youths to dress his food according to the Hindu custom, partaking of it only once in the day. When at home, he wore on his head a velvet cap; the remainder of his dress consisted of a cloth, with a narrow red border, tied round the waist by another cloth of a light purple colour, and of sandals for his feet—his costume was the same as that worn by the Hindu devotees. When abroad, he wore a long gown of light purple colour, with a waist-band of the same colour; on his head was a white turban, covered with a purple cloth, in his hand he carried a handkerchief of the same colour—his ears were adorned with a pair of pearl and ruby ear-rings—his fore-finger with a gold ring. A long cane in his hand, and a pair of slippers on his feet, completed his out-of-door dress. His conveyance was a palankeen, having a tiger's skin for him to sit upon, two persons attended on either side of the palankeen to fan him—a third person carried a purple silk umbrella, surmounted with a golden ball, whilst two others carrying a bunch of peacock's feathers proceeded in front, and whenever he alighted from the palankeen he sat down upon the tiger's skin. In order to preach the gospel with full effect, and to make converts to Christianity amongst the heathens, he made himself perfect master of the Hindu sciences, opinions and prejudices, and conformed to their customs in matters of indifference. In this manner he visited different countries, exposing the fallacies of their doctrine, and the

absurdities of their religious practices. He is much extolled for the triumphs he obtained in the controversial disputes, which often occur amongst the learned in India. He was very liberal in his donations to the poor, and in the erection and repairs of churches. He was assiduous in instructing the youth in different languages and sciences, and in procuring for them situations suitable to their capacity. The first church he erected, was at Conāngooppam Aryanoor, in the district of Paroor,* which then belonged to Mootoosamy Cachirayen, a poligar chieftain. After its completion, Father Beschi proceeded to Mylapoor, and solicited the then bishop of that diocese, to procure for him, from Manilla, an image of the blessed Virgin Mary, in the native dress, with the child Jesus in her arms, according to a model he had drawn for that purpose. The prelate complied with his request, and on its arrival, he performed a devotion of 11 days; and, on the 12th, placed the image in the church which was dedicated to God in the name of the Virgin, Mother of our blessed Redeemer. He founded another church at Tirucavalur,† and dedicated it to the blessed Virgin under the title of Mother of Refuge. It was erected on the land granted to the Christian church, situated at Elacurichy, by Mazhavarāyen. He composed 15 poems in praise of the blessed Virgin Mary.

* Virttachellum talook of South Arcot.

† Insctiption engraved on the stone set on the bank of the tank behind the church at Tirucavālūr, in the talook of Arialoor, Trichinopoly collectorate.

ஸ்வஸ்தஸ்ரீ சாலிவாகன சகாபதம் - ௲௬௱௫௰௭ - ராக்ஷத௵
ஆடி௴ உ௰௬௳ ஸ்ரீமதுராசமாணிய-ராசஸ்ரீ அரியனூரரசினிலையி
ட்டரங்கப்பமழவராயர் ஏலாக்குறிச்சித்திருக்காவலூரில்வீரானதே
வன் வழிக்குக்கிழக்கு-கோவிலூர் வழிக்குமேற்குக்குட்டைக்குத் தெ
ற்கு-பெரியஏரிக்குவடக்குப்பட்டயாவுஞ்சர்வேசுரன்கோயிலுக்குச்
சிலாசாதனமாகத் தந்தோம் - சந்திராதித்தருங் கல்லுங்காவிரியும்
புல்லும் பூமியுமுள்ளளவுஞ் சுகமேயிருக்கவும் - இநதத்தருமத்துக்கு
யாதாமொருத்தன் விகாதஞ்செய்தால் கங்கைக்கரையிலே காராம்
பசுவைக்கொன்ற தோஷத்திலே போகக்கடவான்.

TRANSLATION.

Swasti Sri (may happiness and prosperity attend). In the year Ratchada following the year 1657 of Salivahna (corresponding with A. D. 1734), on the 26th day of Adi-Srimadu, Rāyamāniya Rājestri Rungappa Mazhavarāyer, whose seat of government is fixed in Ariyalur, has caused a stone to be engraved, and granted the whole of the land situated within the limits, from the east of Vīrān dēwan road, to the west of Kovilūr road, and from the south of the pond to the north of Periya Yeri, at Yēla-Curichy Tirucavalūr, for the use of the church of the God of all—to enjov as long as the sun and moon endure, as well as the stone, the river Cauveri, grass and earth exist; if any one act contrary to this charity, may he incur the sin of killing a black cow on the banks of the Ganges.

Works written in Tamil by Father Beschi—*chiefly intended for the use of the Hindu Christians.*

POEMS.

1.—Tembavani*—In honour of the Lord Jesus, the blessed Virgin and St. Joseph. He produced in 1726, the sacred poem called Tembavani, which is by far the most voluminous of his works. It contains 3615 tetrastichs in thirty cantos. To which he added in 1729, to each verse a prose interpretation. The poem comprehends many religious disquisitions and explanations, descriptive of true religion, together with one hundred and five historical passages, taken from the old and new Testaments. It is a work of such great genius and vast erudition that it is admired by all who read it, not only for the sublimity of the thoughts, and the learning it displays, but also for an elegance and purity of style which, it was imagined, no foreigner could acquire. A talent so felicitous and extraordinary has been ascribed to divine assistance.

The poets unanimously acknowledged Father Beschi as their tutor, and with his own permission bestowed on him a high and well merited distinction. Instead of Dyrianatha Swami, that is Father Constantine, which was the name he had borne since his arrival in India, they substituted, the title of Viramamuni, or the "Great Champion Devotee."

Agreeably to the rules of versification laid down in the grammars, the celebrated Tamil poems called Chintamani and Ramayanam, as well as other Indian poems, contain six kinds of rhymes, and these promiscuously used; but the Tembavani is composed in the first sort of rhyme† only, a species of versification difficult to be sustained, but greatly admired for its excellence. With respect to the சந்தம் or cadence, Viramāmuni says in the Shen Tamil Grammar, translated by Mr. Babington, "On this principle, it is very easy to invent new சந்தம் or cadences. Those who are unacquainted with this art, applaud the poet Camben, because in his Ramayanam, which contains 12,016 stanzas, he has introduced 87 varieties of cadence: but in my poem Tembavani, which contains only 3,615 stanzas, I have without

* See Ellis's translation of the Cural, pages 17, 23, 25, 35, 45, 50, 88, 100, 101, 141. Vide appendix of this book. See page 3 of the preface to the Adventures of Gooroo Paramārtan, a tale in Tamil, accompanied by a translation of Mr. B. G. Babington, who says "Tembavani, which, vying in length with the Iliad itself, is by far the most celebrated and most voluminous of his works. To judge from the only padalam or canto, which I have had an opportunity of reading, where the murder of innocents is described, its merits are not over-rated."

† Vide Mr. B. G. Babington's Shen Tamil Grammar, page 75. "If not only the second syllable of each line in the stanza, but the whole of the first foot, with the exception of the first letter, be the same, the verse is esteemed, in proportion to the difficulty of the performance. Thus, if, where (கருவி) caruvi occurs in the first line, (குருவி), curuvi (அருவி), aruvi (உருவி) ooruvi, &c. come in the other lines, the verse will be particularly admired.

any difficulty employed 90 such variations. Indeed it would have been easy to give a different cadence to every stanza; but this could not have been done with propriety, as the same cadence is usually preserved through ten, fifteen, or more stanzas."

Mr. Babington on his return to England took with him a copy of the Tembavani in two volumes folio.

When Sir John Malcolm visited the College of Madras in 1817, Mr. Ellis, in shewing him a copy of the Tembavani, written on cadjan, dwelt largely on the merit of that work. Sir John not only expressed his great admiration of the work but also requested that, as Europeans so rarely acquire a perfect knowledge of Indian poetry, or compose poems of such extent and excellence, in any of the eastern languages, Mr. Ellis would procure him a copy of the Tembavani in cadjans, to take with him to England, for the purpose of placing it in Lord Spencer's library. Accordingly a copy of it was made in cadjans, the two boards of which were ornamented with silver and gold. It was transmitted through the Government of Fort St. George, to Sir John Malcolm, when he was Governor of Bombay, by the College Board of Madras.

I am* happy to state that I have the honour of possessing the copy of the Tembavani, written by Father Beschi's own hand.

A specimen of Father Beschi's poem translated by Mr. Ellis, as also the Reverend Mr. E. Hoole's, are added in the appendix, No. 1, at the end of this paper.

2.—Tirucāvalur Calambacam;† 3. Adeikala Mālei, and 4. Calivenba. Father Beschi composed these three poems in honour of the Madonna, to whom the church at Tirucavalur was dedicated.

5.—Annei Azhemgal Andādi. The poem of the sorrowing Mother, or the lamentation of the Mother of our Lord on his crucifixion. It consists of 100 stanzas composed in the measure called Andādi, in which each stanza commences with the same word that terminates the preceding one.

* On my arrival, duriug my journey abovementioned, at a place called Avoor, twenty miles south of Trichinopoly, I found the Tembavani in Beschi's own hand-writing, in possession of Luz Naig, son of Bungaroo Naig, Beschi's disciple. In compliance with my request, Luz Naig brought the book to Madras for the inspection of Mr. Ellis, who purchased the work for 300 rupees. After taking a copy of it for his own use, that gentleman kindly presented it to me. Mr. Josiah Hudleston purchased Mr. Ellis's Tembavani, when his effects were sold by auction.

† Calambacam—a sort of poetry in which the author mixes at pleasure all kinds of verses. This variation in the measure renders the composition pleasing to the ear, but difficult to those who compose or recite it.

6.—Kittēri Ammal Ammānei. An account of the life and martyrdom of the holy Virgin Kitteri, daughter of Sinakāyen, king of Lusistan who suffered with her eight sisters on the mountain of Bomber, in the year 130, A.D. A poem in 1100 couplets, divided into ten parts.

This probably refers to Quiteria or Citheria, a holy Virgin and martyr of Spain. Martyrologium Romanum, p. 130—Calendar 22d May.

Moreover there are numerous fragments of poems in different kinds of rhyme in honour of the Lord Jesus, and the blessed Virgin Mary, &c.

Works written in prose.

7. Vedhiar Ozhuccam. (The following translation of its contents is by the Reverend Mr. E. Hoole, a Wesleyan Missionary). "It contains clear definitions, offers powerful, and presents affecting appeals, with regard to the work of this class of teachers. It is divided into twenty chapters. The first chapter treats of the nature of the office of catechist; the second, of its importance; the third, of its universal obligation; the fourth, of the preparation to the office; the fifth, of the necessity of self government in those who would save others; the sixth, of caring of others in order to self preservation; the seventh chapter shews that the first means for the salvation of others is personal piety; the eighth, the second means is prayer; the ninth, the third means is desire; the tenth chapter presents motives to quicken a desire for the salvation of others; the eleventh treats on self diffidence and entire reliance on God in the execution of the office; the twelfth, on regarding the souls and not the outward condition of men; the thirteenth, on shewing love to others; the fourteenth, on shewing no desire for the wealth of others; the fifteenth, on regarding the proprieties of time and place; the sixteenth, on yielding to others in order to win them; the seventeenth, on not giving way to discouragement from want of success; the eighteenth, on unity among themselves; the nineteenth, on helps to the office of catechist; the twentieth is an exhortation on attention to the instructions. The whole concludes with questions and assistances for self-examination with regard to duty towards God, personal piety, family religion, duty towards ministers, duty towards the church, duty towards the heathen, duty towards dying persons, duty with regard to hindrances in the performance of the office: and a number of pithy proverbs to be fastened on the memory."

8. The Vēdha* Vilaccam, or illustration of religion. (The following translation of the contents of this book is by Mr. E. Hoole). " The first chapter treats of the rise of protestanism; the second chapter recounts the divisions in the protestant church; the third defends the worship of saints; the fourth, the worship of the Virgin Mary; the fifth assert the antiquity of such worship; the sixth defends the worship of images; the seventh asserts the antiquity of such worship; the eighth is on the decrees of the church; the tenth asserts that the Romish church is the only true church; the eleventh is on purgatory; the twelfth on the sacraments generally; the thirteenth, on the sacraments particularly; the fourteenth, on transubstantiation; the fifteenth, on the sacrifice of the mass; the sixteenth, on the holy Scriptures; the seventeenth, on the miracles of the church; the eighteenth, confirmation of what had been advanced. The work concludes with a confession of faith on the principles defended in it.

" The book then closes with the particulars of the place, date, and quantity of the composition, and the author's name. It is dated 1728."

9.—Pedagamaruttal—Refuting differences.—This work arose out of the circumstances related in the preceding note, and is a reply to the church history of the Tranquebar missionaries, which, instead of 300 pages as stated by Mr. Hoole, consisted according to Beschi of only 13 pages, and was, probably, a totally different work. A copy of it was sent to them by Beschi, but the controversy does not appear to have proceeded further.

10.—Gnana-Unarttal.—Instructions of wisdom.—Remarkable for the beauty, ornament, and elegance of its language. It commences with the most simple, and gradually ascends to the most elevated style of composition. This book was particularly composed as a guide for the preachers of the Gospel.

11.—Tiruchabei Canidam.—A treatise on astronomy, and designed for the use of the church in fixing the observance of Ash-wednesday, and other festivals. This work is in verse and prose.

* This work was composed by Beschi in consequence of an attempt made by the Danish missionaries to circulate, in the vicinity of Tirookavaloor, where Beschi resided, a translation of the new Testament. The missionaries had deputed a zealous catechist for that purpose, and provided him with a large supply of their own version.

Mr. Hoole says that " the publication of a Church History in Tamil, an octavo volume of more than three hundred pages by the missionaries of Tranquebar, afforded perhaps the most suitable answer this work could receive. I was told at Tranquebar that a copy of that History was sent to Beschi, who never ventured to impugn its statement."

In putting forth this statement, Mr. Hoole does not seem to be aware that the work called Pedagamaruttal, the next on the list, was specially composed on this occasion.

Works written in Tamil and Latin, by Father Beschi, *chiefly intended for the use of the European missionaries, &c.*

12. Low Tamil Grammar in Latin, entitled Grammatica Latino-Tamulica, in qua de vulgari Tamulicæ Linguæ Idiomate கொடுந்தமிழ் dicto, Fusius Tractatur. Auctore P. Constantio Josepho Beschio, E Societate Jesu, et in Regione Madurensi, apud Indos Orientales, Missionario.

This is a complete Grammar of the low, and an excellent key to the high dialect. It contains moreover, in a supplementary chapter, "De variis quotidiano usui præcipue necessariis," a variety of information of the greatest practical utility to those, who, by their situation, are compelled to daily intercousre with the Tamil natives. This Grammar was printed for the first, and I believe, the last time at the Protestant Missionary Press at Tranquebar, in 1738, and from copies of this impression, which is not common, an English translation, which, however, cannot be recommended, has lately been published at the Vepery Press.

The College Board printed Beschi's Low Tamil Grammar in Latin, in 1813.

Shen Tamil Grammar.

The Author's Introduction.—C. J. Beschi—*To the pious Missionaries of the Society of Jesuits, Greeting.*

"When I last year presented you with a grammar of the common dialect of the Tamil language, with the view of aiding your labours as ministers of the gospel, I promised that I would shortly say something respecting the superior dialect; but my time being occupied by more important duties, the work was deferred longer than I had at first expected. Urged, however, by the pressing solicitations of my friends, no longer to delay making public the information which I had amassed by a long and ardent study of the abstruse works of ancient writers, but to communicate the fruit of my labours, I resolved to avail myself of the little leisure which I could spare from more weighty avocations, and freely to impart what it had cost me no inconsiderable pains to acquire. I was further encouraged to the task, by my sense of the very favourable reception which my introduction to the common dialect had universally met with. Let me intreat the same indulgence for the present work. That the study will be one of considerable difficulty, I do not pretend to deny; but the labour will not want its reward. Among the natives themselves, very few can now be found who are masters of the higher dialect. He among them who is acquainted even with its rudiments, is regarded with respect; but should he quote their abstruse works, he is listened to with fixed admiration; what praise, then, would they not bestow on a foreigner, whom they should

find deeply versed in a science which they themselves consider scarcely attainable? They will readily attend to the teaching of one whose learning is the object of their admiration. And as this may evidently lead to the honour of religion, and promote the salvation of those about us, I am satisfied that this consideration alone, operating on zeal like yours, will suffice to excite you to the study of this dialect, notwithstanding the difficulties that attend it.

" But since almost all the Tamil works in this dialect are in verse, I trust you will not deem it improper, if I venture to draw your attention to heathen poets, and to the study of poetry. In former times, St. Jerome was severely censured for having, by the introduction of examples from the poets, sullied the purity of the church with the pollutions of the heathen. St. Jerome, in his learned reply, demonstrates, that the apostle Paul repeatedly cites from the poets, in his epistles, and that the most exemplary among the fathers not only made frequent use of illustrations from the writings of laymen, but that, even by their own poetry, they, far from polluting, embellished the church. These remarks apply with particular force in this country, the natives of which are swayed not so much by reason as by authority; and what have we from their own authors to adduce in aid of truth, except the verses of their poets? For, since all their writings are in verse, they have reduced to metre their rules of art, and even the rudiments of their language: whence, they naturally suppose, that he who does not understand their poetry, is totally ignorant. Moreover, there are excellent works in Tamil poetry on the subject of the divine attributes and the nature of virtue; and if, by producing texts from them, we turn their own weapons against themselves, they will blush not to conform to the precepts of teachers in whom they cannot glory without condemning themselves. If we duly consider what has been said, we shall be satisfied, that, in this country especially, it is highly proper in a minister of the Gospel to read the poets, and to apply himself to the study of poetry.

" The first person who wrote a grammatical treatise on this dialect, and who is therefore considered as its founder, is supposed to have been a devotee named Agattiyan, respecting whom many absurd stories are related. From the circumstance of his dwelling in a mountain called Podiamalei, in the south of the Peninsula, the Tamil language has obtained the name of தென்மொழி, or *Southern,* just as the Grandonic is termed வடமொழி, or *Northern,* from the supposition that it came from the northward. A few of the rules laid down by Agattiyan have been preserved by different authors, but his works are no longer in exist-

ence After his time, the following persons, with many others, composed treatises on this dialect, viz. Palacàyanàr, Ageiyanàr, Nattattanàr, Mayesurer, Cattiyanàr, Avinayanàr, Càkkeippàdinivàr. The works of all these writers have perished, and we know that they existed only by the frequent mention of their names in books which are now extant. One ancient work, written by a person called Tolcăppiyanăr (*ancient author*), is still to be met with; but, from its conciseness, it is so obscure and unintelligible, that a devotee named Pavananti was induced to write on the same subject. His work is denominated *Nannul*, a term that corresponds exactly to the French *belles lettres*, and the Latin *litteræ humaniores.* Although every one is familiar with this title, few have trod even on the threshold of the treatise itself. The author divides his subject into five parts, which are comprised in the following line:—

எழுத்துச்சொற்பொருளியாப்பணி

" 1st. எழுத்து—Ezhuttu—*Letters.* This head treats on pronunciation and orthography.

" 2d. சொல்—Chol—*Words ;* which are composed of letters. This head treats of the noun, the verb, and the other parts of speech.

" 3d. பொருள்—Porul—*Matter ;* or the mode in which, by uniting words, a discourse is formed. This head treats on amplification, the affections of the mind, &c. It is subdivided into *agapporul*, and *purapporul ;* that is to say, into *matter interior* and *exterior*, The former relates to the passions and affections of the mind, which act on man internally ; the latter, to things external to man.

" 4th. யாப்பு—Yappu—*Versification.* The Tamil writers confine their remarks on this head to the subject of prosody, and say nothing of the art of poetry.

" 5th. அணி—Ani—*Embellishment.* This head treats on tropes and figures.

The term *Panjavilaccanam*, which we here used, is the general expression for these five heads.

" Pavananti not having completed his design, his *Nannul* comprises only the two first heads, viz. *Letters* and *Words ;* on each of which he has treated at considerable length On his death, a person, named Narccaviraja Nambi, took up the subject, and wrote on the third head, or *matter*. A devotee called Amirdasagaren (sea of nectar), composed a treatise on the fourth head, or *Versificaion*, which he entitled *Carigei ;* and lastly, a person named Tandi wrote on the fifth head, or *Embellishment :* his work was called from him *Tandiyalancaram ;* the word *alancaram* being the same as *ani.*

"On *Amplification* and *Embellishment*, the third and fifth heads, I shall say nothing; because my readers are already acquainted with the rhetoric of Europe, to which nothing new is added by the Tamil authors. As I have also treated fully on the *Letters* in the grammar of the common Tamil, the remarks which I shall here offer on that subject will be confined to the peculiarities which exist in the superior dialect. This work will, accordingly, be divided into two parts; the first of which will relate to *Letters* and *Words*; the second, to *Versification*. Under the latter head, I shall take occasion to say something respecting the art of Tamil poetry.

"In the course of this work, much will be purposely omitted, either as being not of frequent use, or attainable by a little practice: my object being, merely to explain the first rudiments of the language, and thereby to remove the more prominent obstacles which oppose its attainment.

"I shall frequently adduce examples from the most esteemed authors; with the view, as well of illustrating the rules which I may lay down, as of initiating the student into the practice of the language. As many of these examples will appear without the name of the author being annexed, it becomes necessary to explain, that the Tamil writers do not usually prefix them to their compositions; and although the names of some have been handed down to us by their commentators, yet the number of commentaries which have been written on poetical works, is small; and even in these, the author's name is not always mentioned. For instance, the commentator on the poem *Chintamani* speaks in terms of praise of its author, whom he styles the master of all the learned. He may indeed with justice be called the prince of Tamil poets, but of his name the commentator does not inform us. Nor are we to suppose that the work itself is called after its writer; Chintamani being only an appellation bestowed on the hero of the poem, whose name is Sivagan. In like manner, we learn that the poet so well known under the name of Tiruvalluven, who has left us a work containing 1330 distichs, was of the low tribe of Paraya, but of his real name we are ignorant: for although he had no less than seven commentators, not one of them has mentioned it. *Valluven*, is the appellation by which soothsayers, and learned men of the Paraya tribe are distinguished; and *Tiru* here signifies *divine*, in the sense in which we say *the divine Plato*. Such is the origin of this honorary title, which has now come to be used as the real designation of the person to whom it is applied. Again, we have a collection of moral sentences, worthy of Seneca himself, written by a woman, who, if we may believe tradition, was sister to the last men-

tioned author; but her real name also is unknown, although she is always called *Auviyar*, a title which is appropriated to aged matrons. There is another work which I shall occasionally quote, and the title of which is *Naladiyar*, which contains 400 epigrams on moral subjects. The origin of this name is said to be as follows: eight thousand poets visited the court of a certain prince, who, being a lover of the muses, treated them with kindness, and received them into favour: this excited the envy of the bards who already enjoyed the royal patronage, and in a short time they succeeded so completely in their attempt to prejudice their master against the new comers, that the latter found it necessary to consult their safety by flight; and, without taking leave of their host, decamped in the dead of night. Previous to their departure, each poet wrote a *venba* on a scroll, which he deposited under his pillow. When this was made known, the king, who still listened to the counsels of the envious poets, ordered the scrolls to be collected, and thrown into a river, when 400 of them were observed to ascend, for the space of four feet, *naladi*, against the stream. The king, moved by this miraculous occurrence, directed that these scrolls should be preserved; and they were accordingly formed into a work, which, from the foregoing circumstance, received the name of *Naladiyar*.

"I have now said all that I think necessary by way of introduction to this work. In conclusion, I have only to assure the student, that if he will apply himself to the perusal of the ancient authors, he will find their writings to be by no means undeserving of his attention. Farewell! Ides of September 1730."

14.—The Clavis Humaniorum Tamulica Idiomatis, containing five parts complete, like Tonnul Vilaccam in Tamil. It is in manuscript.

15.—Vāmen Cadei—a Tamil story, with a Latin translation, for the readers of high Tamil. This is not printed.

16.—Paramarta Gooroo Cadei—a tale in the Tamil language, for the readers of the common Tamil. This is translated into English by Mr. Babington, and printed in London, in the year 1822.

17.—A Dictionary Tamil and French.

18.—Do. Portuguese, Latin, and Tamil.

19.—Do. Tamil and Latin.

20. *Antalogium Tamulica. This work of great merit could not be found, notwithstanding my diligent search in many places when I

* I suppose Mr. Ellis means the following book, vide Shen Tamil Grammar, page 103. "If I should hereafter have sufficient leisure, it is my intention to make a collection of these expressions from their best authors, and thus to form a Tamil Parnassus."

was sent to the southern country by Mr. Ellis, with particular direction to find out the work.

21. A Latin translation of the two first parts (Arappal and Porutpal) of the Tiruvalluver Cural.

I am enabled to supply some information regarding this work. In 1816 I was sent by the late Mr. Ellis, and Mr. A. D. Campbell, to the south, to procure useful works for the College. In my search for books of that description, I found amongst several works of merit a Latin translation of the Cural, which I forwarded along with other manuscripts to Mr. Ellis. I beg to add an extract from that gentleman's reply to a letter, which on that occasion I had the honour of addressing him, regarding the translation of the Cural.

"The books have arrived safe and I commend your diligence in collecting them. Viramamuni's commentary on the Tiruvalluver Cural is exceedingly valuable, and you must use all your diligence in completing the copy and in endeavouring to bring the original with you to Madras, so that I may be able to compare them and to complete the correction of the copy. Should it be necessary for you to remain longer to the southward on this account, do so, as it is of great consequence that an entire copy of this excellent work should be procured for the College.

"Be diligent in enquiring after another work of Viramamuni and for any other books that may be of use to the College.

(Signed) Yours F. W. Ellis."

"*Madras, 27th September* 1816."

I further beg to add some particulars which I learned from the sons* of Beschi's catechist, regarding the original copy of the Latin translation of the Cural. There were two original copies of that work—one without, another with the Tamil text of Tiruvalluver. It was not known who wrote the former, but it was supposed to have been written by Beschi, and it is well known to the sons of Beschi's catechist, that the latter was written by the Reverend Father Julius Cæsar Potensa, the immediate successor of Beschi, under whom the said persons were disciples at the church situated in Porthacoody, in the district of Trichinopoly, and they were present when the said work was executed by Father Potensa. The said persons also gave me a small book which is with me still, written by Father Potensa. On my comparing

* Dayiriyam Pillei and Amirda Pillei, who were the sons of Chowrimootoo Pillei, Beschi's catechist, and who gave me much information respecting the life of Beschi, as well as his valuable works, and whom I met at Cariyam Putti, a village which is about midway between Tanjore and Trichinopoly.

the little book with the said Latin translation of the Cural, I found that both had been written by Potensa himself. On my producing both the originals to Mr. Ellis, he was unable to ascertain whether Beschi or Potensa was the translator, as there was no title page to either of the copies, but he was inclined to decide in favour of Potensa, because the manuscript was in his hand-writing. He has therefore merely alluded to this translation as the work of "the Latin Commentator," and intended to have entered more fully into the subject in the preface to his own translation, which unhappily he did not live to finish. The portion translated by Mr. Ellis himself was intended to comprehend the first part only, called அறப்பால் (Arappal) on virtue, containing twenty-four chapters.

In pursuance of this resolution, eighteen chapters of the Cural were translated and exemplified with quotations from the best Tamil authors: of these chapters which he translated, thirteen only were printed and the rest are with me still in manuscript, as Mr. Ellis died before he could finish the task he had undertaken.

Works written in Tamil by Father Beschi, intended for the use of the Hindoos in general.

22. Tonnul Vilaccam is a grammar of the superior dialect of Tamil by Father Beschi. This is not only a complete and copious grammar of the language, but, as an enumeration of its divisions will shew, embraces all that is comprised in the scholastic term *humanities.* Its several divisions are, on Orthography, Etymology, Composition, Prosody, and Rhetoric. This work as originally composed by Beschi, contains the substance of the Tolcapiam, Nannul, and other pre-existent treatises on grammar, &c. As usual the rules are in verse, accompanied by a copious explanatory commentary in prose; perspicuity and arrangement are especially attended to, so that a person moderately skilled in the low Tamil might soon make himself master of this grammar.

All the Tamil grammarians treat of certain rules for this species of writing, distinguished by the titles அகப்பொருள் or சிற்றின்பம்—*Agapporul* or *Sittinbam,* meaning sensual pleasure, and of புறப்பொருள் or படைசேவகம்—*Purapporul* or *Padeisewagum,* signifying military service; instead of which Beschi introduces a new series of compositions under the names of அறம்—(Aram)—virtue; பொருள்—*Porul* —matter; இன்பம்—(Inbum)—pleasure; வீடு—(Vidu)—final bea-

titude, which Father Beschi says in the third part of his Tamil Grammar, are the subjects fit to be treated upon as a guidance for authors.

In composing this work, Father Beschi not only intended to define the rules of grammar more concisely and accurately than the ancient ones, but also by means of it to establish the Christian doctrine, which he considered to be more particularly his duty than any other object. With this laudable intention, Viramamuni has taken a couplet from Tiruvalluver's Cural, and illustrated it by several quotations from the Chintamani and Ramayanam, shewing how much they fall short of the standard assumed by the poet, after which he introduces quotations from scripture, and argues from the purity of their tendency that they must have emanated from divine authority. This is introduced in the third part of Tonnul, where he lays down the rules of logic.

Mr. Ellis has translated the above said couplet, and a part of Father Beschi's illustrations, which I have added in the appendix, No. 2. See Ellis's Cural, page 88.

The Tonnul Vilaccam, was lately printed at Pondicherry by one of the native Tamil christians, but, I am extremely sorry to say, it is quite incorrectly done, because the proof sheets of the work were examined by an illiterate Hindoo, who, without understanding the plan of Father Beschi, made several omissions and useless additions to the work.

23.—The Sadur Agaradi—a dictionary of the superior dialect, likewise composed by Beschi: it in fact consists of four distinct dictionaries—the first, *Peyer*, shews the several meanings of every word—the second, *Porul*, the several words bearing the same meaning—third, *Togei*, shews the subordinate species of the technical and general terms of science and literature, and the fourth, *Todei*, is a rhyming dictionary. This work, compiled from the various dictionaries of the high Tamil, of which there are a great number, is the only one which is entirely arranged in alphabetical order, the words in the others (a few sections excepted, in which the alphabetical form is used from necessity) being collected into general classes, and resembling, therefore, vocabularies rather than dictionaries, except that they are more copious.

This work was printed by the Board of Superintendence for the College of Fort St. George, in the College press, in 1824, and re-printed by the Reverend Mr. J. Smith, a protestant missionary of the London Missionary Society, at the Church Mission press at Madras, in the year 1835.

Father Beschi was distinguished for his piety, benevolence and learning. To the conversion of idolators his principal efforts were directed, and they were uncommonly successful on several occasions. He displayed much skill in solving various subtle questions with which his adversaries endeavoured to ensnare him.

On an occasion when he was making a missionary circuit, he happened to halt in a village named Vythisweram Covil, and during his walk through the place, he approached a pagoda, where he observed a concourse of people, some of whom he interrogated respecting the deity to whom the pagoda was dedicated. They replied that it was dedicated to Vineideerthan, and that the blind, lame, &c., were cured by a pilgrimage to this pagoda: whereupon Viramamuni immediately composed the following verse:—

வாதக்காலாந்தனக்குமைத்துனர்க்குநீரிழிவாம்
போதப்பெருவயிறும்பிள்ளையற்கு-ஓதக்கேள்
வந்தவினைதீர்க்கவழியறியான்வேளூரான்
எந்தவினைதீர்த்தானிவன்.*

He who is afflicted with elephantiasis; his brother-in-law with diabetes, his son with a pot-belly, and, moreover, this same Veloorān, being unacquainted with medicine to cure his own disease, what sickness can be healed by such an one?

The assembled multitude who heard this were astonished at his knowledge of their mythology.

Being desirous of having an audience of Chundah Saib, the Nabob of Trichinopoly, he commenced learning the Hindoostanee and Persian languages, and made himself complete master of them in the short time of three months. On his first visit, Chundah Saib, admiring the rare qualities of this distinguished divine, conferred on him the surname (عصمتي سنياسي) Ismattee Sannyasi, indicating his excellence as a religious devotee, and presented him with a palankeen, inlaid with ivory,

* Vydenada Swamy called Vēloorān, the deity abovementioned under the appellation of Vineideerthan, is represented as afflicted with elephantiasis or an enlargement of one of his legs, his brother-in-law, Vishnu, with diabetes, and his son Pilliar or Ganesa with an enlarged stomach. The words here used have also a double meaning. Vadakkal is "Foot upon dispute," alluding to the attitude in which Siva disputed with Kali, dancing on one foot, as well as elephantiasis. Nirizhivu is "running of water," alluding to the Ganges flowing from Vishnu's foot, as well as the disease.

in which his grand-father, Sadoolah khan, used to ride. The Prince also granted for his maintenance a free-gift of four villages, named Bokalur, Malway, Arasur, and Nullur, in the district of Trichinopoly, north of Coladam, yielding a net revenue of 12,000 Rupees per annum, and appointed him to the office of dewan. Whilst in that office he retained the habit of a religious devotee, and on his circuits assumed all the pomps and pageantry with which Hindoo *gurus* usually travel, along with the civil Mahomedan honours, such as chobdars, horsemen, drums, fifes, caparisoned state horses, hurcarrahs, daloyets, nowbut, tents, &c.

Although he was now engaged in state affairs, and continued his study of the Hindu sciences and the composition of several useful works, yet his principal efforts were then directed to the conversion of idolators, whilst he amused himself in the reading of Tiruvalluver Cural, Naladiar, Chintamani, Ramayanam, and other celebrated Hindoo works.

Viramamuni continued to hold the office of dewan in Trichinopoly, until the year 1740, when that city having been besieged by the Mahrattah army under Nather Sing, and Chunda Saib made prisoner, he proceeded to Manapar, and remained there in the service of the church.

But unfortunately a constitution much broken down by incessant study, and laborious travels in countries whose climates are so prejudicial to European constitutions, particularly to one who led such a life as he did, shortened his life; and consigned him to a world of better existence, where he is no doubt gone to receive the reward of a life well spent in the discharge of those duties, which devolved upon him as a man and a Christian. He died at Manapar in the year 1742.

When all the circumstances of his life are taken into consideration, many will be of opinion that such pomp as has been above described did not proceed from worldly motives. Although some of the Missionaries murmured against such proceedings, men of sense will at once perceive that the Jesuits did not display such worldly splendour to improve their income, or to enable them to support their families, for family they had none, and therefore no one can say that they took pains for such purposes, but purely with a view to get the people of this country to embrace the Christian religion. For this sole purpose then the Jesuits assumed the habit, &c., of the Hindoo priesthood, rejecting animal food to which they were accustomed from their infancy, and living on vegetables and other meagre diet, to which Europeans are

not trained, that the cause of Christ may, even at the risk of their health, and other bodily discomforts, not meet with any obstacle on those scores.

The most valuable Missionary of the Society of Jesus, the Reverend Father Roberti Nobili, perceiving that the high caste people of this country had an aversion to the Christian religion, under an impression that in embracing it they would be lowered in the eyes of their heathen relatives, and the intercourse between them in consequence discontinued, and if discontinued nothing could equal such degradation, he, our Christian champion, spared no pains in discovering a method of removing such impression. He was so far fortunate as to find out that it consisted in the manner of living, and this among the Hindoos was of the most harmless and simple nature, and nowise inconsistent with Christian principles, inasmuch as it required only an innocent change by the Christian preacher of his habit and diet to that of the native priesthood. These, though not contrary to the principles of the gospel, yet being in a worldly point of view both unprofitable and prejudicial to health and comfort, were yet readily assumed by our divines, whereby they had the happiness of bringing over to Christianity, not only many men of high caste, but through their means whole Indian tribes. Under these circumstances it must be evident that the assumption of such habit, &c., was caused purely by an ardent desire of promoting the cause of Christianity, and not to obtain any worldly advantage.

As the Jesuits became thorough masters of the languages of the country, and the authors of admired compositions in it? they were therefore qualified to wear the costume of the priests of the country, and to preach with eloquence and persuasive effect, convincing and delighting the natives themselves in the language of the country. Moreover the books of the Jesuits are read by the Hindoos in general with pleasure, to this day, because they are so elegantly and skilfully adapted for inculcating and recommending the Christian religion.

What prevails as rank among Europeans, may in a manner be compared with the caste of the natives. However, there is a difference between rank and caste; because if any European of high rank associates and eats with a low man of his nation, the former cannot be degraded into or become a man of low rank, as the Europeans have never had any distinction of caste, either before or after they embraced Christianity. The natives are differently situated. If a Brahmin or other high caste native associates and eats with a low caste man of his country, the Brahmin will be considered as having become a low caste man, there being separate sorts of foods for the different castes

of this country. There is no such difference in eatable things among people of high and low rank in Europe.

Although the natives do not associate, nor eat with the low caste people of their own country, yet they consider them as themselves with regard to spiritual concerns. The civil distinction of caste cannot therefore be contrary to the second great commandment of God, as it is not applicable to the associating, eating, &c., but refers to spiritual concerns alone. See 14 chapter, verse 17 of St. Paul's Epistle to the Romans, "For the kingdom of God is not meat and drink." In opposition to this Scripture it is asserted that, a Brahmin, Chatriya, Vaisya, or Sudra cannot become a true Christian unless he associates and eats with them the food served on their table, which has been dressed by Pariahs. Surely this is not in conformity with the Scripture of St. Paul. See verse 15, chapter 14 of St. Paul to the Romans, "But if thy brother be grieved with thy meat, now walkest thou not charitably. Destroy not him with thy meat, for whom Christ died."

If we relinquish the distinction of caste we shall be unable to marry the daughters of our heathen relatives, and we should be unable to indulge the hope of our heathen relations becoming converts to Christianity.

The Jesuits being acquainted with all the practices and customs, as above described, did not interfere with them as long as they were not in themselves sinful, nor connected with the heathenish ceremonies of the country. Yet they were very particular in preventing all sinful acts and superstitious ceremonies, by preaching and publishing numerous works, particularizing in them what might be retained and what ought to be rejected, and peremptorily prohibiting the observance of any thing contrary to Christianity.

In other respects they conformed entirely to the customs of the country, in which they lived, according to the example of St. Paul, 1st Cor. 9, 20. "To the Jews I became as a Jew that I might gain the Jews, &c." so the Jesuits assumed the title and appearance of Brahmins to gain the Brahmins. Moreover they abstained from the use of animal food, and lived on rice and vegetables according to the customs observed by the high caste people of this country, for they did not care to pamper their bodies. See St. Paul's 1st Epistle to the Corinthians, chapter 8, ver. 13. "Wherefore, if meat make my brother to offend, I will eat no flesh while the world standeth, lest I make my brother to offend."

Appendix No. 1—*Specimen of Father* BESCHI'S *Poem, quoted by Mr.* ELLIS *in his translation of the Cural; together with some few additional translations of the same poem from my late publication entitled the Padigam.*

ON THE ATTRIBUTES OF GOD.

Vide Ellis's Cural, page 23.

Vira-mamuni, by which title the Rev. C. J. Beschi is best known as a Tamil author, in the 27th book, ஞாபகப்படலம், of his epic poem the Tembavani, commencing with the 156th and ending with the 163d verse, introduces Joseph, the husband of St. Mary, explaining the attributes of the Deity: of these I shall quote only the two first, as the remaining six contain merely the separate illustration of each attribute, of which a shorter and, therefore, more perspicuous explanation will be given from another work. To each verse of this poem the author has added a prosaic gloss, frequently expanding into a comment, from which, as affording a fuller view of the subject than the text, the translation is made.

ஈறிலநன்மைநிறைவுமோர்குறைமுற்
றின்மையுந்தொழத்தகுந்தெய்வ
மாறிலவியல்பேவேரிதாய்க்கிளைத்து
வரும்பலசினையெனநூலோர்
ஆறிலக்கணங்களுரைத்தவையுள்ளோ
னுண்டகையிலனலனென்றார்
தூறிலசுடரைமைவரிந்தன்ன
சாற்றுதும்புன்சொலாலவையே.

மட்டின்றியெல்லா நன்மைநிறைவு மெல்லாக் குறையின்மையு மென்றிவ்விரண்டேயெவரும் வணங்கத்தகு மெய்க்கடவுட்குரிய மாறுதகுணம்தாமே - இதுவேராகக்கொண்டு கிளைத்தபலகொம்புகளின்றன்மையாவிக்குணத்தைவிரித்து நூலோர் மெய்யானதேவனையறிவதற்கா றிலக்கணங்களைச்சொல்வி யவையெலாமுடையோன்றேவனேயென்று ரவற்றுளொனறுயினுங்குறைந் தெல்லாவற்றையுமில்லாதவன்றேவனல்லனென்றார் ஆகையாலளவிறந்தகதிருள சூரியனைமையாலெழுதினுற்போல நானுமென்புன்சொல்லாலத்தேவாறிலக்கணங்களைச்சொல்விக் காட்டுவேனென்றான் சூசையென்க.

தன்வயத்தாதன்முதலிலனாதல்
தகும்பொறியுருவிலனாதல்
மன்வயத்தெல்லாநலமுளனாதல்
வயின்றொறும்வியாபகனாதல்
பின்வயத்தின்றியொருங்குடனனைத்தும்

பிறப்பித்தகாரணனாதல்
பொன்வயத்தொளிர்வான்முதலெலாவுலகும்
போற்றுமெய்யிறைமையினிலையே.

தன்னாலாதலுந் தொடக்கமின்றியாதலுமைம்பொறிக்குரியவுருவில்னாதலு நிலைபெற்றசகலநன்மையுளனாதலு மெங்கும்வியாபகனாதலுந் தன்னையல்லாதோருதவியின்றி யெல்லாவற்றையு மொருங்குடன்படைத்த வாதிகாரணனாதலு மென்றிவ்வாறிலக்கணங்கள் பொன்னொளிர்வானுலகுமுதலெவ்வுலகும் வணங்கத்தகுமெய்க்கடவுளின் றேவதத்துவமிதேயென்றனென்க.

Infinite goodness extending to all and the absolute deprivation of all defect, these two are the appropriate and unvarying attributes of the true God, worthy to be adored by all. From this root the six attributes by which the wise have endeavoured to convey a knowledge of the true God have arisen like branches; they say that he who possesses all these is God, but that he who is deficient in one must, also, be deficient in the rest and, consequently, not God. Therefore, said Joseph, even as they attempt to depict in ink the sun with unnumbered beams, will I in language all inadequate endeavour to explain the six attributes of the Deity.

Existing by himself; existing without beginning; existing independently of the organs of sense; being possessed of everlasting and universal goodness; pervading all space; being the first cause by which all things were created at once and without assistance:—these six attributes describe the divine nature of the true God, worthy to be adored in the heavens, shining like gold, and in all worlds.

These *six* attributes, expressed in the same terms, are, also, found under the word குணம்-௬ in the Togei-yagaradi or third division of Vira-mamuni's Sadur-agaradi, or dictionary of the high Tamil in four parts, and they are, also, enumerated in the commentary on the following couplet, which contains the invocation prefixed to the part treating on prosody in his grammar of the high Tamil, entitled Tonnul-Vilaccam.

யாப்புறநலமெலாமிணைந்தவோர்சட்குணன்
காப்புறவடிதொழீஇக்காட்டுதும்யாப்பே.

Having, to obtain his aid, worshipped the feet of the only God, who united with all good, possesseth the six attributes, I proceed to explain the rules of prosody.

PRAISE OF GOD.

As a further exemplification of the success with which Vira-mamuni has imitated, not merely the expression, but the modes of thought of the previous Tamil writers, the following stanzas are selected from the

Tembavani. In the poem which is added, though by no means intended to emulate this author in perfection of language, a similar imitation of the style of these writers has been attempted; with what success the reader will judge—

அறக்கடனீயேயருட்கடனீயே
யருங்கருணாகரனீயே
திறக்கடனீயேதிருக்கடனீயே
திருந்துளமொளிபடஞான
நிறக்கடனீயேநிகர்கடந்துலகின்
னிலையுநீயுயிருநீநிலைநான்
பெறக்கடனீயேதாயுநீயெனக்குப்
பிதாவுநீயனைத்துநீயன்றே.
கார்த்திரள்மறையாக்கடலினுண்மூழ்காக்
கடையிலாதொளிர்பரஞ்சுடரோ
நீர்த்திரள்சுருட்டிமாறலையின்றி
நிலைபெறுஞ்செல்வநற்கடலே
போர்த்திரள்பொருதக்கதுவிடாவரணே
பூவனந்தாங்கியபொறையே
சூர்த்திரள்பயக்குநோய்த்திரள்துடைத்துத்
துகடுடைத்துயிர்தரும்முதே.

Thou art the sea of virtue, thou art the sea of grace, thou art the most benevolent,

Thou art the sea of power, thou art the sea of prosperity, thou art the sea of wisdom which enlighteneth the mind;

Thou art the confirmation and the life of the world, to whom is no likeness;

Thou art the sea by which I am confirmed, thou art to me as a mother and father; art thou not all to me?

Thou art the infinitely bright and heavenly sun, which cannot be hidden by the assembled clouds and which sinketh not into the ocean;

Thou art the sea of constant felicity which hath neither swell nor wave;

Thou art an impregnable castle which no foe hath ever taken; thou art the mountain which supporteth the earth;

Thou art the life-giving nectar which cureth all distemper, allayeth all pain and removeth all defect.

தேறுந்தயையின்முனிவோய்நீசினத்திற்கருள்செய்கனிவோய்நீ
கூறுங்கலையற்றுணர்வோய்நீகூறுந்தொனியற்றுரைப்போய்நீ
மாறும்பொருள்யாவினுநின்றேமாறுநிலைகொள்மரபோய்நீ [யோ.
யீறுந்தவிர்ந்துன் புகழ்க்கடலாழ்ந் தெனக்கேகரைகாட் டருளா
ஒளிநாக்கொடுவான்சுடர்புகழவொளிநாக்கொடுபன்மணிபுகழக்
களிநாக்கொடுபற்புள்புகழக்கமழ்நாக்கொடுகாமலர்புகழத்
தெளிநாக்கொடுநீர்ப்புனல்புகழத்தினமேபுகழப்படுவோய்நீ
அளிநாக்கொடுநானுனைப்புகழவறியாமூகையுணர்த்தாயோ.

O thou who in thy protecting kindness art angry and in anger delighteth in mercy!

O thou who without instruction knowest all things and sayest all things without a voice!

O thou who in the midst of all things changeable art by thy nature unchangeable!

Wilt thou not vouchsafe to shew the shore to me who am sunk in the everlasting ocean of thy praise?

The resplendent beings of heaven praise thee by their tongues of light;

The various birds praise thee by the tongue of joy; the flowers of the grove praise thee by the tongue of fragrance;

The waters praise thee by the tongue of transparency, O thou who art praised for ever!

Wilt thou not teach me, the ignorant and the dumb, to praise thee by the tongue of love?

மருடருவலியுருவே மருளறுசினவுருவே
யருடருதயையுருவே யளவறுதிருவுருவே
தெருடருகலையுருவே செயிரறுமனுவுருவே
பொருடருமணியுருவே பொழிமணவடிதொழுதேன்.
உளையிலகலைநிலையே யுயரறமடையுளையே
களையிலபடர்கடலே கதியுயிர்பெறுகளையே
வளையிலசுகநிலையே வளர்தவமடைவளையே
புளையிலமனுமகனே புதிமலரடிதொழுதேன்.
மருமலிமலர்நிழலே மறைமலியுயர்பயனே
திருமலிகரமுகிலே சிவமலிதனிமுதலே
யிருமலியுலகுளரோ யிணையொடுதொழுமடியே
குருமலியறநெறியே கொழுமலரடிதொழுதேன்.

O thou who hast the power to cause dread, but art not disturbed by thine anger! O thou by whose mercy grace is vouchsafed and unnum-

bered blessings are conferred! O thou who art the knowledge which giveth understanding, who in the human form destroyedst sin! who art a precious jewel set in gold! I worship thy feet diffusing fragrance.

O thou who possesseth knowledge not conveyed by words and art the word by which the highest virtue is conferred! O thou who art a broad ocean without a shore and the shore attained by beatified spirits! O thou who art eternal happiness without limit and the limit to be attained only by unceasing devotion! O thou, the Son of man without an equal, I worship the newly blown flower of thy feet!

O thou whose protecting grace resembleth the shade of fragrant flowers, who art the exalted sense of the scripture, whose hand, bounteous as the clouds, dispenseth felicity, who art alone the cause of salvation, whose feet those dwelling in the two worlds adore and adorn with flowers, who art both the teacher and the path of virtue, I worship the blooming flower of thy feet!

THE DESCRIPTION OF THE COUNTRY OF JUDEA.

*On the Cloud and Rain.**

புள்ளுலாம்விசும்பிடைதொறும்பொரும்படைபொருவ
வெள்ளுலாமழைவெண்கொடியுருக்கொடுவிளங்கித்
தெள்ளுலாந்திரைதிளைப்பவுண்டெழுந்துயர்பரந்து
வள்ளுலாங்கருமதகரியினமெனத்தோன்ற.
போர்புறங்கொடுபொருந்தலருரத்திறேய்த்தொளிர்வேற்
சீர்புறங்கொடுதிசைதொறுமிருளறமின்னி
வார்புறங்கொடுவளர்முரசொலியெனவதிர்ந்து
நீர்புறங்கொடுநீண்முகின்முழங்கினமாதோ.
படையெனச்செருப்பகைதரப்படர்ந்தனவல்லாற்
கடையெனச்செறிகருணையோடுளூற்றியவள்ளற்
கொடையெனச்செழுங்குன்றொடுவயின்றொறுங்குளிர
மிடையெனச்சொரிவியன்முகில்வரைவில்பொழிய.

As in an army arrayed for battle, over all the sky, where the birds rove, white clouds appear resembling white banners; but, having filled themselves with the clear waves of the ocean, they spread abroad and seem like a mighty herd of black and furious elephants.

Like bright spears glancing from the breasts of enemies in the field

* It is an invariable rule in the Tamil language, after the invocation, and the statement of the subject, to open a poem with a description of the hero's country, and of the capital where he is supposed to have reigned or flourished; and these are represented in the most favourable colours; not such as they are believed to have been, but such as the poet chooses to describe them. In this description, the rains which descend in the mountains, the streams which flow from them, and the consequent fertility of the country, never fail to have their place. Vide page 112, Shen Tamil Grammar.

of battle, they darted their lightnings dissipating darkness in every quarter and, trembling as it were by the reverberating sound of leather-bound cymbols, the black and watery clouds thundered aloud.

Though at first taking the appearance of an army prepared for horrid battle, at length, as the liberal minded bestow their gifts, diffusing coldness over the mountains and the whole expanse of the earth, the extended clouds poured down abundant rain.

ON THE STREAMS.

படித்தநூல்லைபயன்படவிரித்துரைப்பவர்போ
றடித்தநீண்முகிறவழ்தலைப்பொலிந்தபொ[illegible]மலையே
குடித்தநீரொலாங் கொப்புளித்தமுதெனவருவி
யிடித்தருவொலியெழுத்திரையெறிந்துருண்டிரிய.
அஞ்சிலாவெதிரடுக்கியகல்லெலாங்கடந்தே
எஞ்சிலாவெழிலிமைத்தநீண்மருதமுநீக்கித்
துஞ்சிலாநதிதொடர்ந்தகல்கருங்கடனேக்கல்
விஞ்சையாரொலாம்வெறுத்துவீடிவறியபோன்றே.

From Padigam.

நிறைதவிர்ந்துணர்ந்தகாமநெறியிற்கைப்பொருளேபோன்றும்
முறைதவிர்ந்தடைசீர்போன்றும்முனிகடம்முனிவுபோன்றும்
பொறைதவிர்ந்திழிந்தீண்டோடும்புன்னல்மெதிர்கொண்டாங்கத்
துறைதவிர்ந்திடத்திட்டேகித்துளித்ததேன்முல்லைசேர்ந்தார்.
பொய்செலச்செல்லும்வாயிற்பொலிவொடுபெருகும்போல
மைசெலச்செல்லும்வாரிமருளிவந்தளவிற்பொங்கி
மெய்செலச்செல்லும்நன்றெருத்தெங்கணும்விளைவுய்த்தோடிப்
பைசெலச்செல்லும்நாகப்பரிசெனச்செல்லுமாறே.

Like those, who, for the benefit of others, teach the learning they have acquired, the mountains abounding in gold, whose summits are embraced by the clouds, cast forth all the water they had imbibed and the nectarean stream, murmuring incessantly, rolled on its swelling waves.

The streams passed boldly all the rocks that opposed their passage and, leaving the far-extended tract of cultivated land, bright with exhaustless wealth, without stay flowed towards the azure ocean ; as the wise, who, renounciug all, aspire alone to obtain heaven.

The following two streams of the rivers are said to have been crossed by the holy family on their journey from Bethlehem to Jerusalem; and from Jerusalem to Egypt.

They (the holy family) met with a stream which descends from the mountains as speedily as the anger of the holy men is appeased—or, with velocity similar to that with which the wealth of those, who, having forsaken that which is right, abandon themselves to unlawful desires, is dissipated ;—or, to that with which unlawfully-acquired gains are consum-

ed,—and having crossed the current and turned to the right, they arrived at the land of * *Mullei flowing with honey.*

The river pursued its course, increasing in its progress by supplies from different streams swollen by the rains discharged from the passing teeming clouds,—as lies are exaggerated by different fabricators who happen to communicate them in succession,—entering the different vegetable creations,—like truth which carries happy effects in its progress, and winding like a hooded serpent coming on its way.

OPERATION OF CULTIVATION.

From Padigam.

செறியுலாம்புனல்சிறைசெய்துபயன்படவொதுக்கி
வெறியுலாமலர்மிடைந்தகல்வயல்வழிவிடுவார்
பொறியுலாம்வழிபோக்கிலதியல்படவடக்கி
நெறியுலாவறநேரவைநிறுத்தினர்போன்றே.
உவர்க்குந்தாழ்கடலுடுத்தகல்விரிதலைஞால
மெவர்க்குந்தாயெனவெண்ணிலாக்கிழிப்படக்கீறு
மவர்க்குந்தானுணவளித்தலேநோய்செய்வார்க்குதவி
தவர்க்குந்தாவருந்தரும்மென்றியற்றுதல்போன்றே.
கூர்விளைத்தருட்குருவிதிபோன்றென்றுகோடி
நீர்விளைத்தநெல்நிரம்பெனவித்தினரிரட்ட
வேர்விளைத்தபற்கடைசியர்குரவையாடியல்பாற்
றேர்விளைத்தவோர்சிறப்பெழும்விழாவணிபோன்றே.
நோக்கவின்புளநுகரவொண்முளரியோடாம்ப
ணீக்கலாதெலாநீர்மலர்களையெனக்கட்ட
லாக்கமாக்கினுமறனிழந்தாவதுகேடென்
றாக்கமாண்பினரொருங்கவையொழிக்குதல்போன்றே.
பூரியார்திருப்போறலைபசியகூழ்நிறுவி
நீரினூர்தலைநேரநேர்வளைவொடுபழுத்த
வாரமானுநெல்லறுத்தரிகொண்டுபோயங்கட்
போரிதாமெனக்களித்தனர்போர்பல்புணைவார்.
மெய்கலந்தபொய்விலக்கிமெய்கொள்பவர்வினைபோல்
வைகலந்தநெல்பகட்டினாற்றெழித்துவைமறுத்துக்
கைகலந்தடுத்தேற்குநர்க்களித்தபின்களித்துத்
துய்கலந்தநெல்லுண்கவுமீகவுந்தொகுப்பார்.

* Land in India is divided into five kinds, 1st குறிஞ்சி (Kuringee) mountain or mountainous land. 2nd பாலை (Palei) parched or desert land without water. 3rd முல்லை (Mullei) forest or pasture and shrubby land. 4th மருதம் (Marudam) well watered or wet land, fitted for cultivation. 5th நெய்தல் (Neydal) maritime land, or bordering on the sea.

In the Tamil grammars are described the different tribes of men, the different species of animals, birds, trees, flowers, and produce, &c., peculiar to each kind of the said lands.

THE HUSBANDMEN ARRESTING THE STREAMS.

The people arresting the full stream and turning it to advantage, conducted it to the broad field, abounding in fragrant flowers; as, restraining the five organs of sense from their own ways, the wise confine them to path of virtue.

Ploughing.

The extensive earth girt by the deep and salt ocean, supplies with aliment even these ungrateful children who tear and rend her bosom and thus performs an act of charity which is rare even among the penitents who do good to those that hurt them.

Sowing.

The doctrine inculcated by a merciful priest is promulgated after the fashion of the song sung by sowers accompanied with the dancing of the pretty village girls resembling the car drawn festival, viz.—may a grain of paddy nourished by water produce hundred millions of grains.

Weeding.

As the lotus, lily and other water flowers, though beautiful to behold are plucked out as weeds, so sages eschew matters, though productive of benefit, if not virtuous.

Reaping.

The green corn erects its new born stem like the mean suddenly possessed of wealth, but bends its full and ripened head like men of real merit. The husbandmen having cut the sheaves of paddy resembling pearls, collects them into heaps.

Sorting.

Like those who embrace truth avoiding the lies which are mingled with it, husbandmen separate the paddy from the straw by buffaloes, and store up the pure grains, partly for their own livelihood, and partly for the poor who wait for charity.

This is the translation of a choriambic stanza by Vira-mamuni, which, though professedly describing Italy, is entirely in the manner of the Tamil poets and in every respect appropriate to their climate; it forms the example for the construction of the species of verse called calippa, in the fourth part of the Tonnul, *on Prosody.*

(வெண்கலிப்பா.)

சென்றுகநீர்பொழியச்செல்வநிலைக்கறமுமிகப்
பொன்றுகநீர்புரையப்புவனமெல்லாம்புரந்தாண்டே
கருமேவும்வளைதவழுங்கமழ்வயற்பாய்பூந்தடஞ்சூழ்
மருமேவுநிழற்சோலைமயின்மேவிக்களித்தாடக்
கரும்பொப்பச்செஞ்சாலி காய்த்துலர்க்கைக்கடைச்சியரோ

சுரும்பொப்பச்சூழிரப்போர்துதித்துவப்பவீந்தீந்து
மாலைதாழ்குழலசையமணக்குரவையொலித்தாட
ஆலைதாழ்புனலொழுகியலர்வனமுங்கனிபொழிலும்
மல்கிவளர்சிறப்போங்கவளையாச்சீர்மனம்வெறுப்ப
நல்கிவளரீத்தலநன்னாடு.

Here pour the waters from the clouds of heaven,
Diffusing wealth and virtue through the land,
Whose wide dominion, like the ambient sky,
Spread its protecting influence o'er the earth.
To fragrant fields, where creeps the pregnant conch,
From flowery lakes the full stream flows; the while
The peafowl dances neath the verdant shade
Of sweetly scented groves. The ripened rice
Overtops the cane and flowery-fingered girls
With liberal hand to all the poor, who swarm
Like bees around, distribute many a sheaf,
And, while their hair by odorous wreaths adorned
Floats loosely in the breeze, join in the dance
As at a marriage feast, their nimble feet
Accordant to their sounding hands. And here
The luscious juice flows from the cane compressed;
Unnumbered flowerets scent the ambient air;
Unnumbered trees their racy fruits afford.
The various produce of the plenteous field
And boundless wealth that satiates the mind,
Thus yieldeth Italy, delightful land!

On Devotees of the Christian Religion.

The Hindus, however, among whom it originated, have carried their ideas of the "Divine Philosophy" farther than others, as they require, not merely the relinquishment of every selfish attachment, but the utter annihilation of self: even this is not considered by Viramamuni, as inconsistent with doctrines of his own Church, as the following extracts, in which occur the every expressions used in the last quotation, will evince.

பவமேபழித்துப்பூவனத்திற்படர்ந்தவணங்கிற்றுயிர்காத்துத்
துவமேநயனைப்பயத்துய்க்குந் துணையேதென்னின்மன்னுயிர்க்கிங்
கவமேதுயர்செய்நானெனதென்றுயவிருபற்றினிதறுக்குந்
தவமேயுயிர்க்கோர்துணையென்றன்றவத்தின்பவ்வக்கரைகண்டான்

மெய்த்துணையிழுக்கெனத்துறவின்மேன்மையோர்
பொய்த்துணையென்றுதம்பொறிகள்போழ்குவா
ரத்துணைக்கடிந்தபின்னனையர்மற்றிவ
ணெத்துணைக்கொள்பவரொன்னவோதுநீர்.
தான்றனதென்றிருதகுதிப்பற்றனு
நோன்றனவடற்கொடுநூக்கிவானுயர்
கோன்றனதருணிலைசார்ந்தகொள்கையி
லான்றனமதுகைமூவுலகுமாட்டுமே.

When the means are sought by which, forsaking sin, the soul may be protected from the evils spread through the world and everlasting happiness may be obtained; it will be found that devotion, by cutting off the two affections, expressed by the terms I and MINE, *by which immortal souls are here vainly disturbed, is the sole cause of their salvation: thus said Joseph, who had beheld the shore of the ocean of devotion.*

Those who have attained the eminence of devotion and, despising, as illusive, the aid of the body, have annihilated their sensitive organs; after they have thus rejected with disgust corporeal aid, say what further aid they require in this world?

His power, who by the force of devotion has annihilated the two affections, expressed by the terms HIMSELF *and* HIS OWN, *supported by the protecting grace of the most High, the King of heaven, is sufficient to shake the three worlds.*

The first of the succeeding verses is an amplification of the thought in the former part of this couplet, the author having judiciously avoided the incongruous figure with which it concludes. This extract is from the thirtieth canto (Meetchi padalam) of the Tembavani; in which, while the holy family are crossing the desert, on their return from Egypt, the Saviour is represented as enumerating in prophecy the several devotees, who in succeeding times are there to devote themselves to austerities and by their example to introduce monastic discipline into the Church. The primitive ascetics Paul, Anthony and Hilarion are first mentioned, but of the many names that follow few can be recognized, as they are either translated into Tamil or altered so as to conform to the orthography of that language. *Ejesia Mariyal,* celebrated in the concluding verses of the extract is St. Mary the Egyptian, the first female recluse on record in the Christian Church: she was discovered by St. Zosimus in the desert beyond Jordan, where she had passed forty-seven years in the simple attire to which the poet with such delicacy alludes.

அவாவெனமதத்தின்சீற்றத்தறிவெனப்பாகன்வீழ்த்த
வுவாவெனவுடலைக்கைக்கொண்டுக்கநற்றோட்டிமாற்றி
யிவாவனதவக்கவட்டையிட்டிருவிரதத்தூணின்
மவாவனமுனிவன்சேர்த்திவானமும்வியவச்செய்வான்.

வீட்டருநாட்டிற்கேற்றவிழுப்பொருளாகநாடி
யீட்டருஞ்சீலக்குப்பையேற்றிநல்லுயிரோடியாக்கைப்
பூட்டருமேராய்ப்பூட்டிப்புரைநசைச்சேற்றுட்செல்லா
வாட்டருந்தவத்தின்பண்டிமதித்தகன்கதியிற்சேர்ப்பான்.

தேனிமிர்முல்லையாகத்திருந்தறத்தொகுதிநட்டு
நானிமிர்தவத்திற்காத்தநொறிப்பொறிவேலிகோலி
மேனிமிரொழுக்கநீரைவிட்டருண்மணலைப்பாய்த்தி
வானிமிருலகிணுறும்வனத்திணுங்கசோரன்பூப்பான்.

ஆற்றியதவச்செந்தீயிலைம்பொறியிரும்பிட்டூதி
யேற்றியதெருளின்ஞானவிரதமிட்டாயபைம்பொன்
றேற்றியமறையர்சாகச்சிலநன்மணிகள்சேர்த்திப்
போற்றியதேவமார்பிற்புரோதரனணிப்பூணுவான்.

தீயவுநலவுமுள்ளிற்றேறியபெண்ணிற்றேற
லாயவுமரிதேமுன்னரழிந்தநாண்வேலிதாவி
யேயவுங்காமத்தாழ்ந்தவெசிசியமரியாள்பின்னர்
தூயவுமரிதிலோர்ந்துதுறந்திவணெடுநாணிற்பாள்.

கண்மையின்மற்றியாருங்கண்டதன்பிழைகாண்பாரார்
நுண்மையினுற்றபாவநுதலியுட்டானேகண்ட
வுண்மையினுணர்ந்தவூக்கமுளத்திறகாகவெய்திப் [ள்.
பெண்மையின்போர்வைநாணம்பிரிவிலள்போர்த்துநோற்பா

காமமேபறவைத்தேர்மேற்கசடேனும்பாலைசேர்ந்தாள்
வீமமேபறவைத்தேர்மேல்விளைதவக்குறிஞ்சிஞான
வாமமேபறவைத்தேர்மேல்வளரறமுல்லைசேர்ந்தெண்
ஞமமேபறவைததேர்மேனயபபவாணுட்டைச்சேர்வாள்.

When by the outragious fury, of the passions the driver had fallen from his seat, Mavavana muni, having seized and mounted the elephant, which is the body; governing him by the strong hook of resolution, he will bind him to the pillar of constancy by the rope of penance, and fill all heaven with admiration.

Desirous of obtaining the wealth peculiar to the kingdom of heaven, Madittagen having heaped on the car of unceasing penitence a load of holiness and yoked to it, as oxen, his body and soul, avoiding the quagmire of sinful desire, he will arrive at salvation.

Having planted the honey-dropping jasmin-vine of perfect virtue; having surrounded it with a hedge of subdued senses, to protect it by

penance supported by religion; having let in the water of strict discipline and spread around it the sand of grace, Asoren will flourish as a garden whose fragrance reacheth to heaven.

Blowing the red furnance of penance and placing therein the iron of the five senses, adding the mercury of bright wisdom, Purodaren poured the pure gold thus obtained into the mould of religion and, having enchased it with precious jewels of virtue, he became an ornament for the breast of the God he adored.

Though women may inwardly resolve on good or bad it is difficult for them to persist in their resolution; thus, though the Egyptian Mary, overleaping the fence of modesty, had at first plunged into the sea of carnal desire, yet at last, having determined to perform austerities with the purest devotion, she will retire from the world and long remain here.

The eye perceives not the colour by which it is darkened, and who are they who see their own faults apparent to all others? but she remembering of herself her minutest sins and borne on the wings of mental resolution, produced by reflecting on the truth she perceived, gave herself up to devotion covered only by the mantel of female modesty.

On the flying chariot of desire she arrived at the desert of sin; on the flying chariot of fear she repaired to the mountains of penitence; on the flying chariot of resplendent wisdom she entered the grove of growing virtue; and on the flying chariot of my name she shall enter the kingdom of heaven.

வீடுறவேண்டினீவிதித்தநூலெலாந்
காடுறவொளிக்குதல்கயங்குளிக்குதல்
நீடுறவிழுச்சடைநீட்டன்மற்றவை
யீடுறப்பயனிலாவெளிறிதாமென்பார்.
சடைவளருருக்கொடுதவிர்கினீர்குளித்
தடைவளர்வனத்திடையகன்றிலாத்திரிந்
திடைவளர்கனிகளோடிளங்கிழங்குணும்
முடைவளர்கரடிகள்முனிவரோவென்பார்.

சுரத்திடைத்தழலொடுதுறும்புருக்களு
மரத்திடைத்தூங்கிநற்கனியுண்வாவலு
முரத்திடைத்துறவரோவுளத்தின்மாண்பலாற்
பரத்திடைக்கிளர்வினைபரியுமோவென்பார்.
செம்பொறிச்சினத்தபோர்ச்செறுநர்க்கஞ்சலாற்
பைம்பொறியெயிலின்வாய்ப்படியப்பூட்டியுள்
வெம்பொறியெழத்தமைவெட்டிவீழ்த்தெறு
வைம்பொறியடக்கியுள்ளவாக்கொண்டாலென்பார்.

On the false Devotees.

If, said the devotees, everlasting happiness be desired, it may be obtained by the rule thou hast propounded and not by seclusion in the wilderness, bathing in fountains, or cherishing long locks of tangled hair, for these and similar acts cannot produce eminent virtue; all this is utter ignorance.

Will they call the rank bears devotees because their bodies nourish tangled hair and they fail not to bathe in water, or because they unceasingly wander through the leafy woods, or because they feed on the fruits and tender roots therein produced?

Will they call the doves that rove amid the heat of the parched desert, or the bats hanging from the trees and feeding on their choicest fruit, the greatest of devotees; how without purity of mind can the sins formerly committed be cleared away?

As one, who, after having firmly fastened the gates of the threatening battlements, from fear of an invading enemy enflamed by rage, urged by his own innate fury stabs himself and dies; so is he, who, although he restrains the five outward organs of sense, is ruled by inward passion.

A Controversy between the Domestic Life and Retirement.

In the fourth canto of the Tembavani (Pālamātchi padalam), Viramamuni introduces a controversy between the youthful Joseph, who, desirous of leading a life of devotion, had retired to wilderness, and an Angel in the form of an old-man, on the relative merits of seclusion and social life: from this the following extract is taken.

நாடொறுங்கனிந்தசெந்தேனற்கனியளித்தனன்றே
கோடுறுமரமுந்தன்னைக்கொடுத்தலேநன்றேயிவ்வா
றீடுறுமுளனுமுள்ளுமீதல்செய்துறவேயென்பார்
வீடுறுநாலோரென்னவிளம்பினானிளவல்மாதோ.
காயொடுமரந்தந்தாற்போற்கடித்துறவருமைவெஃகி
வேயொடுநெருங்குங்கானில்விழைந்துதானொழுகனன்றே
தீயொடுகுழைமற்றேருஞ்செவ்வுறச்செலுத்தனன்றே
தூயுடுவுணர்வோயென்னச்சொற்றினான்குரவனம்மா.
பெற்றறமணிந்தநல்லோய்பிறர்மனைவிளைத்தசெந்தீ
யற்றறவோடித்தன்வீடழன்றதேபோலவேட்கைப்
பற்றறவுணர்த்தியுள்ளம்பற்றியநசையில்வெந்தா
விற்றறவுறுதியென்னோவென்றனனரியகுசை.
தீதிலாவிடமேவேண்டிற்சேணுலகெய்தல்வேண்டுங்
கோதிலாவனத்துந்தன்னைக் கொணர்ந்தகால்விலையும்வெம்போ

ரேதிலாதொழுகலுள்ளத்தியல்பினாலாகுமன்றி
வாதிலாவிடத்தாலாகாமைந்தனேயென்றான்சான்றோன்.

" Is it preferable to present daily the honey-dropping fruits, or to offer at once the tree with all its branches ?" for, said the youth, "the learned say that for the devotee to offer himself and all that he possesseth is perfect devotion."

" O thou who art possessed of pure knowledge" said the old man, " whether is it preferable that a man, offering, as it were, the tree with all its fruits, should dwell alone in the wilderness, choaked with bamboos, and attached only to the practice af austere penance, or that he should conduct others involved in sin, in the right path ?"

" O excellent man who art adorned by virtue," said the eminent Joseph, " is it right, that, while a man is instructing others to assuage the fire of passion he himself should be exposed to be consumed by it, like a man whose own house is burned while he runs to quench the flames which have caught his neighbour's house ?"

" If thou art desirous of being where no sin is, thou must seek that place in heaven ; even when retired to the wilderness, the asylum of innocence, the war of the passions may still rage ; freedom from sin proceeds from strength of mind, not from difference of place, O my son !" replied the Sage.

The argument is thus continued through many stanzas, the disguised Angel maintaining the superiority of domestic virtues and the youthful Saint extolling the virtue of retirement. It concludes with the following verses.

பாற்கலந்திட்டதெண்ணீர்பால்குன்றும்பண்புமில்லால்
மேற்கலந்தொளிர்ந்தவெய்யோன்வெயிலுமுன்னெரித்ததீபம்
போற்கலந்திசைத்தமற்றைப்புண்ணியந்துறவுவாய்ந்த
சாற்கலந்தியல்பையேற்றுந்தகுதியோவென்றான்பாலன்.
தெருட்டகுமுணர்விற்சான்றோன்சேடனைத்தழுவிச்சொல்வா
ன்ருட்டகுமுணர்வன்பூக்கமரும்பொறையீகைமற்ற
மருட்டகுமியல்தீர்மாட்சிமதியைமீன்சூழ்ந்ததேபோற்
பொருட்டகுநாட்டில்வைகும்பொலந்துறவணியுமன்றே.

" Like milk mixed with water, which by diluting it decreases its natual properties, or like a lamp burning before the beams of the bright-rayed sun shining on high," said the youth, " are all other virtues, which in truth are only sound, and can these, therefore, add any thing to the high eminence acquired by devotion ?"

The Sage of lucid intellect tenderly embracing the youth said; " As the stars surround the moon, may not benevolence, knowledge, affection, constancy, forbearance, liberality and other unillusive virtues adorn devotion though it be practised in a country abounding in every species of wealth."

To those who remember the scope of the controversy between the Jansenists and the Jesuits, though this, like other phantasies of the same kind, is fast fading from human cognizance, the following quotation will not be unpleasing: it is curious, also, as a specimen of the dexterity with which the author seizes every handle offered him, if it seem likely to become a useful instrument in the prosecution of his labours, and of the sophistical, but characteristic, ingenuity, with which he endeavours to reconcile doctrines in reality incompatible. The terms தலைவிதி *the destiny of the head*, and தலையெழுத்து *the writing of the head*, used in this extract belong properly to mythology, which feigns, that, previously to birth, the destiny of every individual is written by Brahma in the head of the embryo; this writing, it is supposed, is seen in the indented line which marks the sutures of the skull.—See the 27th canto (ஞாபகப்படலம்) of the Tembávani; the controversy here detailed between Sivasiven, who supports the character of a Hindu guru, and Joseph, commences with the doctrine of the metempsychosis, from which it naturally deviates to the subject of destiny and the origin of good and evil.

கூறியவிந்நிலையுளதேற்குன்றுடனு
  முடல்வனப்புங்குறையும்வாழ்வும்
மாறியவிந்நிலையுலகில்வழங்கியகா
  ணீதியிதோவழுவோகூறுய்
தேறியவிந்நிலைமிக்கோவென்றுசிவா
  சிவன்கேட்பத்தெளிந்தவார்வத்
தூறியவிந்நிலைமதுச்சொற்பூங்கொடியோ
  னுரிமறைநூலுணாத்தான்மீண்டே.
ஆதியிலாவீறுமிலாவினையின்றி
  யென்றுமுளோன்மல்னென்றே
பேதியிலாவான்வருமெம்முயிரும்
  படைப்புண்டபின்னீறில்லா
வோதியிலாமற்றுயிர்கள்முதலீறுள்
  ளன்வென்னவுரிநூலீதாய்
நீதியிலாநவையுறுமுன்முதற்படைப்பெம்
  முயிர்கொண்டநிலைமையென்றே.

பார்முகத்துமுதலுடல்புக்கெம்முயிர்க
டோன்றியகாற்பரிவற்றெல்லாச்
சீர்முகத்துவாழரசாயாவருங்கொல்
பன்முகத்துச்சென்றொன்னிற்
பேர்முகத்துவயத்திறையோனீதியதோ
நீதியதேற்பிறழாநீதி
யோர்முகத்துமுன்வினைகளின்றியின்று
மிவ்விகிர்தமுள்தாமென்றான்.
முற்பிறப்பின்விடங்கமுறத்தலைவிதி
காரணமென்றான்முன்பானீதி
தற்பிறப்பினன்புயர்ந்தோன்வேறுபட
விதியெழுதுந்தயவேதென்னச்
சொற்பிறப்பினடங்காதான்றிருவுளமே
யெனவன்னான்குசைமீண்டே
பிற்பிறப்பின்வீற்றியற்றுந்திருவுளமுந்
தானென்றாற்பிழையோவென்றான்.
தெருட்செல்வமிக்கிறையோன்முட்டிலத்தும்
பெய்முகிற்போற்சிந்திப்பெய்த
பொருட்செல்வம்வறிதென்னப்பூரியர்க்குஞ்
சால்பிறைப்பான்பொருவாமாட்சி
யருட்செல்வநசைக்களவாயாவருங்கைக்
கொண்டோங்கவயமேதந்தான்
மருட்செல்வமற்றவையுமாகியது
வறப்பயனேமதியின்மிக்கோய்.
சுலத்தெல்லாமோர்நிலையோதருக்கெல்லா
மோர்கனியோதரணியெங்கு
நிலத்தெல்லாமோர்விளைவோநமக்கெல்லா
மோர்முகமோநிலையும்பல்லாய்க்
குலத்தெல்லாம்பொதுநின்றுகுன்றாச்சீ
ரறமொன்றேகுறையொன்றின்றிப்
புலத்தெல்லாமாகுமெனிற்புறவிகிர்த
மொன்றென்னார்புலமைமிக்கார்.
காறுபடுந்திறத்திவன்கைப்பொருள்வற்கே
யிவற்கவன்கைக்கருமம்வேண்டி
வேறுபடுமனுக்குலமேயொருப்படுத்து
மிருகையாமிடிவாழ்வன்றிக்
கூறுபடுந்திறத்தென்றும்வாழ்ந்தறவோ

சழத்தியோர்குவ்விற்காண்டி
வீறுபடுநாளில்வருமிருவினைவி
யாப்பயன்பின்பில்லையென்பார்.
திறந்தகாவாழ்விதுவாய்த்திறம்பாவான்
வாழ்வதெனத்தெளியநாமே
பிறந்தகாலுயர்குலமுஞ்சீர்த்திறமுந்
தெரிந்திங்கண்பிறப்பாரின்றி
யிறந்தகாலுயர்வான்மேவிணையாவாழ்
வுற்றாருமியல்பொன்றன்றே
மறந்தகாநல்வினைநாஞ்செய்யளவொத்
தன்றேவர்க்கும்வழங்குமென்றான்.
ஏற்றருமுணர்வினோயியைந்தநானலோர்
போற்றருமூழ்வினையெனப்புகன்றபின்
மாற்றருந்தலைவிதிமறுப்பவோவென்றான்
தேற்றருமயிற்பறவளனுஞ்செப்பினான்.
ஊழ்வினையென்னினுமுரிமையோர்ந்துழி
மாழ்வினையியற்றநீவகுத்தவக்கரத்
தாழ்வினையென்பவோவிறைவன்சாற்றிய
கீழ்வினையிலமறைவிரும்பிக்கேட்டியால்.
நீட்டியவிதியலாற்செயப்படாச்செயுங்
கோட்டியவினைவிதிகோட்டமாமலால்
வாட்டியமனஞ்செயும்வடுவதோவிவ்வா
றீட்டியவறமறமிரண்டிலாமரோ.
இவ்விதியிலையெனவியம்புமூழ்வினை
மெய்விதிமறையினால்விளங்கமாக்களைச்
செவ்விதியிறைவன்முன்றிருட்டித்தாயகா
லுய்விதியிழந்தவர்க்குற்றதோதுவாம்.

வாயேயுணுநஞ்சுறுப்பெல்லாமருவிவருத்தும்வண்ணமெனத்
தாயேதாதைகொண்டவினைதனையராநாங்கொண்டழுங்கத்
தீயேவியதீதொடுசெனித்துத்தெளியாவுணர்வின்மனங்கலங்க
நோயேபாலுண்டிடர்கரத்தினுடங்கவினையின்விளைவுற்றோம்.
சொன்னகுரவர்காலமெனத்துதிநூலோர்முற்பிறப்பென்றார்
முன்னமவராலெமக்குற்றமுதியவினையூழ்வினையென்றா
ரின்னவினையல்லாதுதலையெழுத்தும்வேறூழ்வினையுமிலை
யன்னபிறப்பல்லாதிறந்தேயுயிர்த்துபிறப்பாரிலையென்றான்.

" *Although what thou hast spoken is right,*" *yet, said Sivasiven,* " *do thou, who art learned in this species of knowledge, declare, whether, if the effects of the deeds of previous births be denied, the inequality of men in this world, some being deformed and some beautiful, some happy and some miserable, be just or unjust;*" *then Joseph the bearer of the flowering rod, whose pleasant speech flowed from a mouth graced by kindness, again explained the scriptures of the true faith.*

" *He, who hath neither beginning, nor end, nor similitude, is the everlasting, sole, all-righteous God; the celestial beings and our souls, between which there is no difference, having been created, have a beginning, but no end; irrational beings have both a beginning and an end; this being the true faith, in what state were our souls when first created, before they had been guilty of any crime?*

" *When our souls first entered our bodies and appeared in the world, did they resemble prosperous princes free from all misery? but though they did not and though their condition therefore, was various, was this inconsistent with the justice of the Almighty God? if it were just then, also, must the inequality of men in their present generation be immutably just, without reference to the effects of their former deeds.*"

The former, Sivasiven, said—" *that it was destiny which was the cause of inequality at the first generation of mankind;*" " *but, said Joseph,*" *is it consistent with the mercy of the Almighty, the God of justice and mercy, to predestine such inequality?*" " *It is the divine will of him who is beyond expression,*" *rejoined the other.* " *Then, replied Joseph,*" *can it be wrong to say that it is the divine will which causes the various qualities of those born in after generations?*

" *As the clouds pour down rain even in the thorny wilderness, so the all-wise God scattereth abundantly the vain wealth of this world even among the unworthy; but he hath given power to all, to each according to the intensity of his desire, to attain to the matchless glory of the wealth of grace: can it be then said, O thou of superior understanding! that the other kinds of wealth, which are in truth illusory, are the reward of virtue?*

" *Do all streams meet at one place? do all trees bear one sort of fruit? Is there one kind of production from all soils? have all one countenance? As all these are different, so differ the conditions of men, but virtue only, a species of wealth liable to no diminution, is common to men of all ranks; those eminent for wisdom, therefore, describe it as common to all and make no other distinction respecting it.*

"*As the wealth of the rich is necessary to the poor and as the industry of these is necessary to those, so wealth and poverty resemble the two hands, uniting the several classes of mankind; if the virtuous were always seen rejoicing in prosperity and sinners weeping in adversity, they would then deny the retribution for good and evil at the last day.*

"*That we might understand that the prosperity of this world is not constant and that the felicity of heaven is eternal, we know not, said Joseph, at our birth whether we are born to high rank and fortune, but, if desirous of attaining the unequalled joys of heaven, we know at our death that they will be in proportion to the works we have performed during life.*"

"*O learned man worthy of all praise,*" *said Sivasiven,* "*as the wise assure us that unavoidable effects proceed from the deeds of former births, can it be said that there is not an inevitable destiny?*" *Then Joseph, desirous to satisfy all his doubts, however difficult to clear up, answered thus;*

"*When the nature of that which the wise have called the effect of former acts is rightly perpended, can it, as thou hast affirmed, be considered as proceeding from a prescribed destiny? Listen sedulously to the explication of the exalted faith taught by the Lord.*

"*If there be a prescribed destiny it is impossible to avoid it; all crooked actions, therefore, must be considered as the fault of destiny, not the fault of the mind which it affects; all virtuous actions, also, must be referred to destiny and cannot be considered as virtues of the mind; consequently, neither virtue, nor vice can be attributed to men.*

"*To demonstrate that which is called the effect of former acts not to be destiny as thou thinkest it, I will declare, as it is stated in the scriptures of the true religion, what occurred, when the impartial God created mankind, to those who had forfeited their lives.*"

Note.—Here follows an account of the fall of Adam and Eve, which concludes with the two following verses.

"*As poison swallowed by the mouth spreadeth agony through all the limbs, so we, their children, are born to the evils arising from sin, by which we are afflicted in consequence of the acts of our common parents, and to the pains caused by mental confusion proceeding from an overclouded understanding; vexed by the hand of sorrow, we receive the whole fruit of their acts.*

"*The period of the creation of our common parents, here mentioned, the illustrious sages have called the former birth, and the acts done by them in ancient time, the evil effects of which we experience, they have called the effects of former acts; besides that which is here stated, there is no prescribed destiny, nor effects from former acts, nor, after men have been born and have died, are they liable to any future birth.*"

Specimen of Father BESCHI's *Poem, translated by the Rev.* Mr. E. HOOLE, *and published in his Narrative.*

THE DESCRIPTION OF THE CITY OF JERUSALEM.

பயனினுன்மறைநூலொக்கும்பகலினைமணியாலொக்கும்
வியனினுலுலகமொக்கும்வேலியாற்கன்னியொக்கும்
முயவினுலலையையொக்குமுனிமுனிவொன்னார்க்கொக்கும்
நயனினுலுயர்வீடொக்குநகரினையொக்கும்வீடே.
பொற்றங்குமுலகந்தன்னைப்பொங்கிருங்கடல்சூழ்ந்தென்ன
விற்றங்குமிரவிகாலும்வெயிற்பிழம்பனையநாறிச்
செற்றங்குமலையினோங்கிச்சேணுறுமதிலைச்சூழ்ந்த
வெற்றங்குமலையைமாறியிகன்றகலகழித்தோற்றம்.
பூவுலகியல்பன்றம்பொற்பொலிமணிநகரம்பொன்னார்
தேவுலகுரிதென்றங்கட்டெளிந்துபுக்கிடுமென்றாழி
தாவுலகிருத்தவெள்ளித்தாடலையிட்டதேபோற்
கோவுலவிஞ்சிசூழ்ந்தகுவளைநீளகழித்தோற்றம்.
சீரியார்நட்புவேர்கொள்சீரொனநிலத்திற்றாழ்ந்து
பூரியார்நட்புப்போலப்புணர்ந்தசைவலமேலாடி.
நாரியாரழகுகாணநாணியகமலமிங்கண்
வேரியாரிதழைப்பூத்துவெறியெறியகழித்தோற்றம்.
ஈரும்வாளெயிற்றின்கூன்வெண்ணிளம்பிறைதோன்றவூனைச்
சோரும்வாய்விரித்துக்கட்டீய்ச்சொரிதரவகழிதாழ்ந்து
பேரும்வாயுருக்கொண்டன்றுபேய்க்குலம்வெருவுய்த்தெய்தி
யூரும்வாயென்னவங்கண்ணுழக்கியவிடங்கரீட்டம்.
ஓவலிற்றெழிற்பூமாதேயுவந்தநாட்செறிந்தகற்றை
தூவலிற்பகல்செய்பைம்பொற்சுடர்முடிசூழ்ந்ததென்ன
வாவலிற்கிளர்நன்றுட்கொண்டடிகடம்மனத்தைக்காக்குங்
காவலிற்கதுவிடாதகனகமாமதிலின்றோற்றம்.
காரணிபசும்பொற்குன்றின்காட்சிபொன்மதிலைச்சூழ்ந்து
சீரணியனைத்துஞ்சேர்த்தசெழுநகர்திறந்தவாயில்
பேரணியவையுமீட்டிப்பின்னவையுவப்பிற்காட்டப்
பாரணிப்பேழையாரும்பயன்படத்திறந்தபோன்றே.

"This city, from its universal advantages, may be compared to religion; from the brightness of its ornaments, may be compared to day; from its extent, it may be compared to the world; from the keeping of its walls, it may be compared to a pure virgin; from its crowded state,

it may be compared to the sea; to its enemies, it may be compared to the anger of saints: for goodness, it may be compared to heaven, and heaven may be compared to this city.

"*Like as the great sea surrounds the golden world (earth) so was the beauty of the wide moat varying its bright waves, and surrounding the walls (of Jerusalem), which shone like a multitude of the solar rays, rose like a mountain to the water of the clouds and pierced the sky.*

"*This extensive moat at the foot of the heaven-reaching walls, seemed like a silver shackle to detain the beauteous city on the sea-girt earth, for fear it should esteem the earth an unsuitable situation, and ascend to heaven as a more appropriate place.*

"*This moat was deep as the deeply-rooted affection of the great; the green weeds in it played on its surface, unstable as the affection of the mean; and the lotus outshone by the beauty of the damsels, could not stay within the city, but here opened its tender leaves and breathed its fragrance.*

"*There were swarms of contending crocodiles, shewing teeth sharp as a sword, and curved like the fair new moon, opening their fleshy mouths, and flashing fire from their eyes, as though the moat had formerly been deepened to hell, and the demons lying there had assumed and wandered about in a terrifying form.*

"*The beauty of the golden walls, was as though the ever-fair earth on a day of rejoicing, had put on a crown of pure and radiant gold; they were no more to be surprised than the temper of holy men, who are filled with goodness beyond desire, and who keep their minds.*

"*As the golden mountain is surrounded by clouds, the city surrounded by a wall enclosing all wealth within it, had a gate which when opened was as though the earth had opened a casket, in which all its treasures had been collected with a desire to display them for universal advantage.*

"The remaining part of the description is equally imaginative; designed to please the fancy of a Hindoo rather than to convey a knowledge of facts.

"The following extract will exhibit the method in which *doctrine* is inculcated in the Tembavani—the two first verses are represented as

the words of the Saviour, addressed to Joseph; the third contains Joseph's reply.

உள்ளியதவநவ்வேறியூக்கநீண்மரத்தைநாட்டி
விள்ளியவன்புமுட்டும்வியனிருபாயும்பாய்த்தித்
தெள்ளியவரக்கால்வீசத்தியானமீகாமனுக
வள்ளியவினைநீரீர்த்தார்ந்தரிதில்வீட்டுலகிற்சேர்வார்.

வவ்வியதவங்கெட்டம்மாமரக்கலங்கவிழ்ந்ததேபோ
லவ்வியமுன்னீர்மூழ்கியழுந்துவர்பலரிவர்க்குட்
கவ்வியவுணர்வின்றெப்பங்கண்ணினீர்க்கடலைநீந்திச்
செவ்வியகதியின்வீட்டைச்சேர்வரோரிருவரொன்றன்.

மெய்க்குடத்தமிர்தண்டன்னவிரித்தசொற்செவியின்மாந்திப்
பைக்குடத்தனையதீயார்பான்மையென்றுன்னுசுட்ட
வக்குடத்தழிவுதீர்த்தலரிதெனத்தவநீத்தாரு
மிக்குடத்தனையதெற்றொன்றனன்மதுப்பெய்கோலான்.

"*Embarking on the ship of true renunciation of the world, and setting up therein the tall mast of strong determination, spreading the two broad sails of devotion and godly fear, whilst the breeze of the excellent gifts of God blows upon them, the pilot of unceasing meditation steering them through the sea of this sinful world, they shall reach the desired haven of eternal bliss.*

"*But whilst the ship of renunciation thus sails along, some, by corruption of the penance they had commenced, will sink into the sea of sin, and perish as though by the upsetting of the vessel: some among them (one or two only) seizing with earnestness the raft of repentance and floating in a sea of tears, directing their course straight-forward, shall obtain the joys of heaven. Thus, although it is difficult rightly to perform penance, it is far more difficult for those who leave off that which they had commenced to reach the shores of heaven.*

"*Joseph, the possessor of the branch which blossomed with honey-dropping flowers, attended to all the divine Son uttered; and by the mouth of his ear drinking in the nectar poured from the vessel of truth, thus replied: We may consider the wicked like to an unbaked earthen vessel, which when broken it is easy to join again, and to bake in the furnace of penance; but as it is impossible to join again a vessel broken after it is once baked, so it is most difficult for those who have left off to be penitent to be restored.*"

Appendix No. 2—Illustrations made by Father BESCHI *on a couplet of the Cural.*

See Ellis's Cural, page 88.

மனத்துக்கண்மாசிலனாதலனைத்தறன்
ஆகுலநீரபிற.

That which in spotless purity preserves
The mind, is real virtue; all besides
Is evanescent sound.

" That which in spotless purity," &c.—Vira-mamuni in the third book of the Tonnūl, பொருளதிகாரம் (Poruladigaram) *on the subject matter of composition,* has particularly examined and illustrated this couplet. He introduces it twice; in the first chapter, in which the rules for the composition of prefaces are stated, and in the third chapter, on amplification, where it is made the thesis of a theme or dissertation, intended to exemplify that species of composition. In the former it is thus paraphrased.

இல்லறந்துறவறமெனவிவ்விரண்டினுள்ளு மடங்கிநிற்குமெல்லா வறங்களுமனத்தின்றூய்மையாற்பேறும்பெருமையுமடையுமெனவும் மனத்தினுள் மாசுகொண்டவன் செய்யுந்தவமுந் தானமுமற்றயாவு மறத்தினரவமாவதன்றியறத்தின்பயனுளவல்லவெனவு. மக்குறளிருபயனிவையெனவிரித்துக்காட்டுதும்விரிப்பவே.மெய்யும்பொய்யும்விளங்கியுட்பயன்றருமெய்யறத்தின்றன்மையேவெளியாயிஃதோன்றுணர்ந்துநாமதற்கொப்பநடந்தாலிதுவீடெய்தும்வழியெனக்காணப்படுமே. பெரும்பொருணேர்ந்துபொய்மணிகொள்வதுகேடென்றுயினும் பொருளைநேர்ந்து முடலைவாட்டியுமுயிரைவருத்தியுமேற்கதிவீட்டிற் செல்லாச்சிலபொய்யறங்களையீட்டுவத்திலுங்கேடாமன்றோ. இதனை விலகித் தன்னுயிராக்கங் காப்பது வேண்டி யிக்குறட்பயனாராய்வது நன்றே.

Every species of virtue is included under the two general heads of domestic virtue and religious virtue. It is here said, that by purity of mind, eminence and worth is obtained and, that devotion, or charity, and all other acts performed by one whose mind is not pure, hath only the empty sound and not the essence of virtue. The two significations of this Cural are thus distinctly shewn. When thus explained the truth and falsehood shine forth, and the true nature of virtue, whence substantial profit is derived, becomes apparent, and if we reflect on this and act accordingly, the path leading to salvation will be seen. Although loss be

sustained by the expenditure of vast wealth in the purchase of a false jewel, is it not yet a greater loss, after the wealth has been expended, the body emaciated, and the soul afflicted, that a few, false virtues only, not current in heaven, should be collected? avoiding this, therefore, and endeavouring to preserve that which is really profitable to the soul, reflect seriously on the purport of this Cural.

The following extracts from the dissertation of which this couplet is the thesis contains the citations from Tamil writings made by this author in direct illustration of it.

புறத்தறச்சாயற்புகழ்ப்பிறர்மெய்த்-திறத்துளந்தம்மைத்தீயெனச்சுடச்சுடச்-செறிவாய்மருளறத்தெளிந்துமெய்மைகண்-டறிவாரறப்பயனுறையுட்பட்டார். இதனாலன்றோ

வானுயர்தோற்றமெவன்செய்யுந்தன்னெஞ்சந்
தானறிகுற்றப்படின். என்றார் அன்றியும்

நீட்டியசடையுமாகிநீர்மூழ்கிநிலத்திற்சேர்ந்து
வாட்டியவுடம்பின்யாங்கள்வரகதிவிளைக்குமென்னிற்
காட்டிடைக்கரடிபோகிக்கயமூழ்கிக்நாட்டுணின்றும்
வீட்டினைவிளைக்கவேண்டும்வெளிற்றரைவிடுமினென்றான்.

துண்டுகில்வேகலஞ்சிநெருப்பகம்பொதிந்துநோக்கிக்
கொண்டுபோய்மறையவைத்தாற்கொந்தழல்சுடாதுமாமோ
கண்டத்திறவியார்தங்கடிமனைதுறந்துகாட்டுட்
பண்டவாவுளநீங்காதேற்பாவமோபரியுமென்றான்.

இங்ஙனேபுறத்தவவேடமன்றியுள்ளத் தூய்மையில்லா முனிவர்க்குச்சிந்தாமணியிற்சீவகன்சொன்னான்.

வானோர்புகழ்ந்துவணங்கியதுறவுந்
தானோர்பயனிலதாராதகத்தழுக்
காறுளதேலெனிலகத்துளறத்தின்
பேறுளதென்பதுபிழையோவென்பார்.

என்பதிவையுமித்தொடக்கத்தனபலவுங் கரிப்புறத்திணையாம்-இவ்வாறேனைத்திணைவேண்டுளிவிரித்துக்கூறுக.

Those desirous of obtaining the fruit of virtue, having freed themselves from the delusion, arising from the applause given by others for the appearance of virtue, while in reality their conscience burned within them like a fire, will comprehend the truth. For this reason hath not the Author said thus?

CURAL.

Of what account is the understanding, which reaches beyond the heavens, if his heart suffer from conscious guilt.

And again;

CHINTAMANI.

If it be thought eternal felicity can be obtained by wearing long and matted hair, by bathing in water, lying on the ground, and emaciating the body, then may the bears that bathe in the lakes and wander in the forests, also, obtain felicity;—quit, said he, such ignorant notions.

If from fear of a fine cloth being burned you place it within the very fire, will it not be consumed? So, if they, who forsake domestic life and the society of those whose bosoms are perfumed by civet, retain in the wilderness their ancient desires, will they, said he, be freed from sin?

Thus, in the Chintamani, Sivagen addresses one, who, void of inward purity, has assumed the garb of outward devotion.

If the mind be inwardly impure, even devotion, which is reverenced and praised by the heavenly beings, will produce no permanent fruit, but can they impute guilt to him (even if such ceremonies be omitted) who is endowed with inward virtue?

These passages and many others like these prove what has been stated by direct examples, if further illustrations be required they may be given at large.

Note—Mr. Ellis has translated only a few out of many reasons and rules connected with logic and corresponding with the above subject. The following is the last part of the same.

These extracts are intended to exemplify the position, that, whatever eminence may be acquired, neither virtue nor the permanent benefit of virtue can be possessed by those innately wicked; they are from the 2d canto (இராவணன் மந்திரப்படலம்) of the sixth book (யுத்தகாண்டம்) in which Cumbacarnen, one of the brothers of Rávanén, reproves, in a council of the Giant chiefs, the conduct of the former, in forcibly seizing and detaining Sitei, the wife of Rámen, and vainly endeavours to persuade him to restore her to her husband. Previously to the holding of this council, Anumán, one of the leaders of the silvan tribes that accompanied Rámen to the attack of Ilangei, who, though in the form of an ape, was in reality an incarnation of Pavanen, the god of the wind, had penetrated to the capital of Rávanén in search of Sitei and, having been taken prisoner, had been allowed to depart after his tail, wrapped in oiled cloth, had been set on fire as the punishment of his in-

trusion; with the torch so furnished him, he had laid the whole city in ashes, finally escaping unhurt in defiance of the utmost efforts of the Giants:—hence the allusions in some of the following verses.

Rámāyanam.

ஓவியமமைந்தநகர்தியுணவுளைந்தாய்
கோவியல்பழிந்ததெனவேறொருகுலத்தோன்
றேவியைநயந்துசிறைவைத்தசெயனன்றோ
பாவியருறும்பழியிதிற்பழியுமுண்டோ.

Thou hast caused a beautiful city to be devoured by the flames; is it right to desire the wife of one of another race and to detain her in captivity as if thou hadst lost every kingly quality? is any sin the wicked commit a greater sin than this?

என்றொருவனில்லுறைதவத்தியையிரங்க
வன்றொழிவினாயமறைதுறந்துசிறைவைத்தா
யன்றொழிவதாயினவரக்கர்புகழ்ய்யா
புன்றொழிவினுமிசைபொருந்தல்புலமைத்தோ.

Contrary to the precepts of religion, thou hast detained in captivity and overwhelmed with sorrow, a woman who was engaged in devotion, belonging to the house of another, O perpetrator of violent acts! and if in that day the glory of the Araccar was obscured, would it be wise in us to sanction so disgraceful an act?

தூயவர்முறைமையேதொடங்குந்தொன்மையோ
ராயவர்நிற்கமற்றவுணராதியாந்
தீயவரறத்தினாற்றேவராயது
மாயமோவஞ்சமோவன்மையேகொலோ.
அறந்துறந்தமரரைவென்றவாண்டொழிற்
றிறந்தெரிந்திடிலதுதானுஞ்செய்தவ
நிறத்திறம்பாவகையியற்றுநீர்மையன்
மறந்துறந்தவர்தரும்வரத்தின்மாட்சியால்.
மூவரைவென்றுமூவுலகுமுற்றுறக்
காவலினின்றுதங்களிப்புக்கைமிக
வீவதுமுடிவெனவீந்ததல்லது
தேவரைவென்றவர்யாவர்சீரியோர்.
வினைகளைவென்றுமேல்வீடுகண்டவ
ரெனையரென்றியம்புதுமிவர்தந்திய்மையான்
முனைவருமமரருமுன்னும்பின்னரு
மனையவர்திறத்தினையாவராற்றினர்.

The ancients followed the path of the virtuous, but besides these all the other Auner (Giants) are evil doers: the station of gods is obtained by virtue, but is it obtained by delusion, deceit and violence?

If we consider the mighty deeds by which, even after we had forsaken virtue, we conquered the gods, we shall find that they were not an effect proceeding from any acts of devotion performed by ourselves, but from the power conferred on us by those who had forsaken evil (i. e. by the Sages and the gods by whom we were endowed with power).

Having conquered the divine Triad, and having received under their protection the whole world, while exulting in prosperity, they are dead and have toiled in vain; who then among the conquerors of the gods are truly great?

Who shall describe those, who, having overcome both good and bad works, have obtained eternal felicity? but who among these, the giants, have, from their innate wickedness, at any time performed virtuous acts like the sages and the gods?

கோனகர்முழுவதுநினதுகொற்றமுஞ்
சானகியெனும்பெயருலகின்தம்மனை
யானவள்கற்பினாலழிந்தவல்லது
வானரஞ்சுட்டதென்றுணர்தல்மாட்சியோ.

This royal city and thy former victories have been consumed by the chastity of Janiki, the mistress of the world; if not, what glory is there in the thought that they were burned by an ape?

மீனுடைநெடுங்கடலிலங்கைவேந்தன்முன்
றானுடைநெடுந்தவந்தளர்ந்துசாய்வதோர்
மானிடமடந்தையாலென்றவாய்மொழி
தேனுடையலங்கலாயின்றுதேர்தியால்.

It was foretold that the power of the king of Ilangei surrounded by the ocean, obtained by long penance, should decline by means of a female of the human race; know this to be now accomplished, O thou who art adorned with a wreath of sweet flowers!

மனவிருளிரிய மணிவிளக்காகத் தனியருளிறைவன் றந்தமறைநூலாய்ந்துழியீண்டியா னறைந்தயாவும் வாய்ந்தமெய்யென வழங்கித் தோன்றுமே.

நுந்நாயெனபுகழ் நுவன்றுபாட வெந்நாவெரீட்பலி மென்மேற்கொன்றிட அப்புகழப்பலி யனையநும்மனம். ஒப்பிலாதென்னையொருவிநிற்றலால். அவையெலாம்பொய்ப்பொருளாகக்கைக்கொளா

நவையென வெறுத்தனேஞனேயெனவும். புணர்ந்திடத்தேவ பூசையி
னேர்ச்சி கொணர்ந்துழிபகையுட் கொண்டதென்றுணர்கின். அகன்
றப்பகைதீர்ந் தல்லாற்பூசையு நகன்றுமறுப்ப. ஞனேயெனவும்.
மாசிலான்மறையென வறைந்தபின்மனத்துண் மாசிலனுதலே
மாண்புறுமனைத்தற னல்லதுதீயவையகத் தொளித்தினிய. வல்லுருப
காட்டன் மாணறமென்பவோ என்பதிவையுமித்தொடக்கத்தன ப
லவுநூற்புறத்திணையாம்.

All that I have stated will be verified, if you look at the true religion which was inculcated by the one only gracious God, who said, as precious light to expel the darkness of the mind, thus;

[Amos 5, 21.] I hate, I despise your feast-days, and I will not smell in your solemn assemblies. Though he offer me burnt offerings and your meat offerings, I will not accept *them*: neither will I regard the peace offerings of your fat beasts.

[Samuel i, 15—22.] And Samuel said, Hath the Lord as great delight in burnt offerings and sacrifices, as in obeying the voice of the Lord? Behold, to obey is better than sacrifice, and to hearken than the fat of rams.

[" Matt. ch. v. 23—24.] Therefore if thou bring thy gift to the " altar, and there rememberest that thy brother hath ought against " thee; leave there thy gift before the altar, and go thy way; first be " reconciled to thy brother, and then come and offer thy gift."

Explanation of the word ஆகுலம், *introduced in the foregoing couplet or text.*

" All besides is evanescent sound"—The term in the original, translated by the two concluding words, is ஆகுலம், which signifies literally *a loud turbulent noise;* the line is thus translated and explained by the Latin commentator. " *Cætera omnia conditionem habent strepitus.* Sensus est eam esse veram virtutem, quæ in animo culpam non admittit, nam animum culpa fœdatum habentis, verba, et habitus, et actiones ipsæ quæ virtutem spirent, habent conditionem strepitus; tum, quia ad id ordinari solent, ut a cæteris videantur et audiantur; tum, quia eo tantum tempore quo videntur et audiuntur, ut virtuosa laudantur, sed statim, uti strepitus, evanescunt, quia non valent alicui beatitatem afferre." I have followed this interpretation as it agrees with that of

Vira-mamuni, and as it corresponds exactly to the expression of the original; but the word ஆகுலம் may metaphorically be rendered, *ostentation, hypocrisy.* Parimel-azhager paraphrases it by ஆரவாரம் which signifies literally the *confused clamour arising from a mob,* but is often synonymous with இடம்பம், the term commonly used to express *pomposity, ostentation, hypocrisy.*

VI.—*Notice regarding the Sects of Hindus called Tengala and Vadagala.* —*By* C. P. Brown, *Esq.*

The following brief notice regarding these sects is now collected from living authorities, who themselves are Bramins of the Tengala sect.

The Vaishnava sect in the peninsula of India is divided into two classes, called Tengalas and Vadagalas, who hold each other in religious hatred. These divisions affect Sudras as well as Bramins.

They are known from one another by the mode in which they wear the mark in the forehead. Each sect wears an upright yellow or red streak, down the forehead. And on each side is a white line; these converge at the brows, forming an appearance like a trident.

The Tengalas draw the line low down the face. The Vadahalas draw it no lower than the brow.

The Tengala marks join on the nose. The Vadagala mark does not. The Tengala wears a line across the face between the eyes, somewhat like a crescent.

The Tengala women wear the yellow upright line: a few women wear the lower mark. No woman wears the white marks.

The particular saint of the Tengalas, whether Bramins or Sudras, is *Manavala mā muni;* who wrote the comment on the *Dravida Prabandham (*or *Tamil Veda),* written by the twelve saints called Alwars. This sage has been deified by his followers, while Vedantachari is adored by the Vedagalas. He and his *opponent* (a phrase which they disown) were pupils of *Ramanujachari,* commonly called *Bhashya-carlu,* or the "Commentator" on the Divine Texts. It is to be observed that neither sect speaks disrespectfully of the leader or apostle of the opposed sect. And it is not easy to comprehend how both teachers can be supposed to obey the doctrines of Bhashyacarlu.

The prayers they use are similar, except as to the commencing stanza. The Tengala mantram or verse runs thus:

> Sri Sailésa dayā pātram, dhī bhacty ādi gun'ārn'avam
> Yatīndra pravan'am vandé Rámyajā mātaram munim.

But the Vadahalei exordium runs thus:

> Rāmānuja dayā pātram, jnāna vairāgya bhūshan'am
> Srī madvēncata nādhāryam vandē vēdānta Dēs'icam.

In the former verse Rāmyaja Matrĭ is the name of Manavala mamuni: in the latter, Védanta Desica is the title given to Védantachari.

It seems that the former verse is used in all the temple at Combacōn'am, and that at Manjācuppam, north of Pondicherry; perhaps at a few others.

This verse is used in *private* by the Vadagalas, but if they ever venture to recite it audibly in a Tengala pagoda it is resented as blasphemy, and leads to great outrages.

Ten-calei, denotes *Southern Veda;* and *Vada-calei* denotes the *Northern creed.* These words form the origin of Tengala and Vadagala,

Among the Vadagalas widows are shaved. This custom the Tengalas reject. There are some other discrepancies. They intermarry and eat together.

But the discriminative mark in the forehead is the great sign, and so important do they hold this that various Vishnu temples have the sectarial mark cut in stone over the gate.

The discussion regarding this mark is traced to a difference of opinion as to the signification of a celebrated Sanscrit text or half verse, which directs that the mark in the forehead shall be *Nāsādi kēsa Paryantam*, " from the nose to the hair." Now the Vadagalas say this expression *from* the nose denotes not any *part of* the nose, and therefore they begin the line between the brows.

The Tengalas deny this; and dividing the nose into three parts, declare that the *upper third* of the nose is included in the word ādi. For they argue that " every thing has a beginning, a middle, and an end; and in the verse in question the word " adi," *beginning*, denotes the first portion."

This discussion (a counterpart to that of the big-endians in Swift's description of Lilliput), has led to serious disturbances and the loss of many lives. Nor does any annual feast occur without a recurrence to the wrangling regarding the celebrated verse now cited. It is not even satisfactorily ascertained in what book this verse is recorded. A

learned Tamil divine, who died about fifteen years ago named Annavappengar, author of a commentary on the Uttara Rama Charitra, wrote likewise a polemical volume on this topic.

It is to be observed that both sects worship the same god Vishṇu; and use the same rites. Their differences regard none but points which are known to be mere trifles. Indeed, they chiefly regard particular customs connected with eating and drinking.

The Ecādasi Srāddham is not practised by the Tengalas, nor do they use the bell in worship.

The Tengala sect has prevailed greatly over the other, who are nearly silenced both at Sri Rangam, (Trichinopoly) and Madras.

At the sacrifice called Yajna, the Tengalas say they use the *pishta pasuh,* or small figure of a goat, made of paste. The others use the *chhaga pasuh,* or living goat. But in fact both sects have laid aside the yajna: which the Smartas continually celebrate. Hence among the Tengalas and Vadagalas, the name Somayazi is laid aside: for that title appertains to the Bramin who has celebrated this sacrifice.

VI.—*Note on an Ancient Hindu Grant.—By* Walter Elliot, Esq.

Some time ago I obtained a set of copper-plates, united by a ring in the usual mode of ancient Hindu grants, bearing an inscription in a character which was said to be unknown. The plates are three in number, $7\frac{8}{10}$ inches long by $1\frac{1}{2}$ in breadth, of a shape differing from any I had hitherto met with. Unfortunately the symbol on the ring or seal is defaced. The plates were said to have been found in the *kol,* or lake, near Masulipatam, some years ago, and had been laid aside as utterly unintelligible.

Several of the letters being nearly identical with the Hala Canarese alphabet, most of the words were with some difficulty deciphered. The characters bear a considerable affinity to those of an inscription from Amrawutty, published in the Journal Asiatic Society* of Bengal, but appear to be of a considerably older date, if such an inference may be drawn from the ruder and more simple forms of the letters, as will appear from the fac-simile opposite, which shows likewise the shape and size of the copper-plates. The language is Sanscrit, the style being simple

* Vol. vi. p. 218—Pls. xi. xiii.

though old, and some of the terms obsolete. A transcript in Nagari is given, the translation of which is as follows:

" Salutation!

" From the victorious Vengipur, Maha-raja-sri-vijaya-Nandi Varma, " bound up in meditation on the feet of the Lord Chitra Ratha Swami— " devoted to the feet of the saints (Bhaturakas)—the most pious—the " eldest son of Maha Rajivacha Varma and of Kulanka—commands the " villagers, and the head inhabitants of the village of Vidanūrpalli, in the " district (Vishaya) of Kūdūhāra—Hail!—On account of the virtue of " my imperishable Kula and Gotra, and for the increase of my personal " reputation, the village is bestowed (vrittaha) on the Bramins re- " siding in the excellent agraharam of Chinnapākūrvaka, of various " gotrams, readers of the vedas, who are in number 157—knowing this, " let all that is proper to be relinquished, be given up, by the Rajah's " public officers, who have authority over the land (desadipati), and let " it be maintained.

" On the eighth day of the decreasing moon, in the month of Poushya, " in the 7th year of the prosperous reign, this grant [pattika] is made. " Let the grantees enjoy it in virtue of this order.

" Land has been given by many, and it has likewise been continued by " many. Whosoever possesses the land shall enjoy the fruits for the " time being.

" The giver of land rejoices in heaven for 60,000 years. He who takes " it away, or consents to its resumption, shall remain for the same period " in hell."

This ancient deed though unfortunately destitute of an ascertained date, is possessed of considerable interest, from the indication it affords of the dynasty which ruled in the tract now known as the Northern Circars, but anciently as the Venga, Kalinga, or Andhra Desams, anterior to the Chalukya family.

The earliest grants of the latter race occur in saca 528, corresponding to A. D. 606, and I have lately had opportunities of examining copper sasanams, given by different princes of this house, in sacas 897 and 1001, which clearly show by the more modern form of the writing, the superior antiquity of that of Nundivarma.

In these documents the genealogy of the Chalukyas is brought down to the union of the family with that of the Cholas of the south, about the close of the 10th century of the Salivahana æra, without the mention of any names, bearing the least resemblance to Rajivaksha Varma or Nundivarma, and as the country over which they reigned is invari-

ably termed Vengidesam, we may conclude that the Nandivarma who reigned at Vengipur must have been anterior to the 7th century.

No such names as Nandivarma's or his father's occur in any of the lists of the Southern Dynasties, except in that of the Vijayanagur Rajas,* but the Nanda who is there said to have founded Warungol and Nundapur in A. D. 1034, (?) cannot possibly be identified with the Nanda of the inscription, for at this period the Chalukyas were the lords of Vengidesam.

Of the limits of Vengidesam or Vengi Mandalum, it does not appear necessary to say more at present than may tend to illustrate the site of Vengipur, the capital of Nundivarma.

Four places of this name are found in the Northern Circars. Two of these named Chinna Vengi and Pedda Vengi are situated close to each other, in the vicinity of Ellore; another is found near Chintapalli in the Guntoor district, and the 4th is a deserted site, named Vengipad, in the Palaveram zemindary, to the north-west of Rajahmundry.

The following account of the two first mentioned places was received from an intelligent native, who made the inquiries on the spot.

" About eight or ten miles north of Ellore, is situated the village of Peda Vegi, half an hours walk to the north of which is Chinna Vegi, and five miles south of these, is another village named Dendûlûr, with several hamlets attached to it, named Ganganagudem, Sanagudem, &c. According to the local tradition all these formerly constituted one large city, in which were numerous temples dedicated to Siva. The ruins of about fifty fanes sacred to this deity, still exist in Dendûlûr, and likewise four statues or idols of Vigneswara, one of which, very large, is on the southern side of the village, near a tank surrounded by date trees. A high mound of earth called Bhimalingam Dibba is found on the east side of the village, and a tank, named Macalama cheravu, to the north, has a mound in the centre, on which are two stone bulls. There is another tank to the west of the village, called Narikalawari cheravu, on the banks of which are two sila sasanams, standing upright, and two more which have fallen down, but which were erect about four years ago.

" Between Pedda Vegi and China Vegi is another remarkable mound. All of these places above mentioned are supposed to conceal enormous treasures. In later times Pusapati Madava Varma reigned in this place."

The above are sufficient indications of the site of a large city, and the inscriptions noted as still existing at Dendûlûr, will probably throw further light on the subject. Wangipur in the Guntoor district seems to be

* As. Res. vol. xx.

a place of no importance, but at Vengipad, north-west of Rajahmundry, there are said to be extensive ruins, but the head serishtadar of that district, in reply to some questions addressed to him, states, that the local tradition of that province, points to Pedda Vegi in the Masulipatam district, as the former site of Vengipur.

In the preface to the Telugu translation of the Mahabharat, Rajahmundry is styled the "central gem of Vengidesam," "Nayakaratnam." Campbell's Tel. Gram. pref. p. x. At that time it had become the capital of the Chalukyas, and the ancient capital must have been in a state of decay.

Of the other places mentioned in the deed, little information is obtainable. Kuduhara is said to be the ancient name of the district now occupied by the Collar lake.

The local tradition states it to have been formerly inhabited by certain Bramins, who became so wicked that they provoked the divine vengeance, and were destroyed by the God of fire. One virtuous Bramin alone, and his wife, received timely warning to fly, the remainder were all burnt up, and the earth sank to the depth of 24½ cubits: in proof of which it is asserted that, on digging in any part of the lake during the hot weather, the soil displays signs of the action of fire. This may refer to a volcanic phenomenon having caused the subsidence of the tract.

Vidanur palli has not been recognized, but mention is made of Chinnapakur in an ancient MS. account of the district of Condavir, forming part of the Mackenzie Collection, and noticed by the Reverend Mr. Taylor in his 4th Report at vol. ix. p. 13 of this Journal. At p. 12 of the MS. it is stated that Bala Bhaskara Deva of the Gunapati race, made a grant of 360 kundees of land, to the Bramins of 12 gotras in Chinnapakur or Kurupadu, and gave it the name of Muppala, in the saca year 1056 (?). And again, at p. 18, in a list of villages which have a Samprati or Curnum of the Balikuruwar race and Sandilya gotra, it occurs in the following order.

Gundala.
Velanadu.
Betpudi.
Narayanpuram
Chinnapakur
Muppalapudi.
Gollapadu.
Munagapadu.
Buckapuram.

Chitraratha is a title of the sun.* It occurs as the name of one of

* Wilson's Dictionary in verb.

the Pandyan Dynasty of Madura.* What particular deity is designated by Chitraratha Swami, seems doubtful, some consider it a designation of Siva, others of a Jain divinity.

VII.—*Note on the Defaced state in which the Statues of the Jains are now generally found, as connected with the persecutions and overthrow of that People.—By Lieut.* T. J. Newbold.

The mutilated state in which the statue presented to the Society, and others surrounding it, were found, bears silent testimony to the rancorous spirit with which the Brahmins and Jangams persecuted the Jains; and which impelled them, as we are assured on the testimony of many native writers, to wreak their vengeance, unglutted by the overthrow and expulsion of the rival sect, upon their senseless temples and images, and to do their utmost to obliterate every trace of the heretical creed from the face of the earth. In various localities that I have visited in Mysore, the Carnatic, the eastern portion of the Southern Mahratta Country, and the Nizam's territories, the Jaina *bastis* have been converted into temples consecrated to *Mahadeo*, the *Lingum*, &c. The most prominent distinguishing marks of their origin are commonly obliterated; but it frequently happens that some small bas-reliefs of the Jaina *Tirt'hankars*, or of the female effigy canopied by the uplifted trunks of two elephants, have either escaped notice, or been permitted to remain from their insignificance, sufficiently indicative of the religion of the builders. The larger and detached images are either destroyed or disfigured; and thrown outside the walls of the place. The Brahmins, even at the present day, declare it to be unlucky to look upon the countenance of a Jaina image: consequently the features of the statues have rarely escaped mutilation or destruction.

At Bagwari in the Southern Mahratta Country, near which place *Basava*, the celebrated founder of the Jangam sect, and subverter of the Jaina kingdom of Kalyan was born, are many marks of the furious spirit of extermination: the numerous Jaina temples have, with two exceptions, been levelled with the dust, and their remnants, in the shape of broken altars, and elegantly carved pillars, employed in repairing the walls of the town. One of the two *bastis* left standing has been converted into a temple to the apotheosis of the arch prose-

* Prinsep Us. Tab. ii. 121.

cutor of the Jains—*Basava,* and the other into a manufactory for earthen ware. Similar evidences of this spirit are visible among the ruins of Annagundi, Bejanugger, and at Courtney, in the Ceded Districts. The latter, now an insignificant village, was formerly a place of importance under *Jaina* ascendancy: one of its principal *bastis* is occupied by the sacred feet of the Indian Mars—*Comarswami*—images of the god *Ganesa*—the goddess *Parvati*—the bull and *Lingum.* Another has been converted into a mosque by the Mahomedan followers of Hyder and Tippoo, and a third forms the *Math* of a Jangam priest. The large image of one of the *Tirt'hankars,* is seen cast outside the western gate, disfigured in the usual manner, and the lower extremities buried in soil. The destruction and defacement of the Jaina inscriptions on stone, and substitution of others in their room, are much to be lamented, and I would strongly urge the Society to direct its attention towards the copying of all such as still exist in various parts of the peninsula, before it be too late. The rancour of the Jangams and Brahmins towards the Jains still exists in smothered, though unaltered, bitterness. The copies should be taken, if possible, by means of Jaina scribes in order to avoid forgeries, alterations, or interpolations. The indefatigable and successful exertions of Mr. Walter Elliot have already gone far to place the history and chronology of peninsular India, on a surer and more solid basis than hitherto, grounded on the chronicled and unbiassed information contained in 595 inscriptions on stone and copper, collected in various parts of the Southern Mahratta Country, Mysore, the Nizam's dominions and Sunda.* It is scarcely necessary to remark how extremely valuable such information is, gathered from these mile-stones of time's course; and that a wide field still remains untrodden to all who, imbued with a liberal zeal for the advancement of knowledge, enjoy similar opportunities of collecting it.

Although the Jains were not able to defend their temples and larger statues from profane hands, they contrived to carry off the smaller images, and many of their sacred books, which they preserve with the jealousy natural to the weaker sect. The smaller images that I had opportunities of seeing in Canara and the Southern Mahratta Country, were all either of brass or a white slightly veined† marble, which is said to be brought from the *Uttara Des,* or country north of the Nerbudda, and represented the twenty-four *Tirt'hankars,* both singly and in groupes, in their peculiar standing or sitting-at-ease postures. The

* Vide Madras Journal, vol. 7. p. 193.

† Marble appears to be a sacred stone among the Jains, being always preferred when procurable, and is sometimes brought from great distances.

Jaina colossal statue of *Gomúta Raya* on the rock of *Sravan Belgola,* in Mysore, said to be 70 feet 3 inches in height is of granite. The Duke of Wellington, who visited it, was of opinion that the rock had been cut down until nothiug but the image remained. This opinion I found corroborated by the testimony of the priests and natives of the locality, and the truncated shape of the rock on the summit. The jealousy of the Yaitis permitted only a cursory examination of the base, which has every appearance of having been cut down to the plane on which it rests, and was probably one of those prodigious blocks, frequently seen as tors and logging stones on the granitic elevations of peninsular India. In gazing on the gigantic proportions of this colossus, and the hill constituting its base, from the plain below, one cannot avoid being reminded of the story of Dinocrates the sculptor, proposing to cut down mount Athos into a stupendous statue of Alexander, holding a town in his left hand, and in the right a large basin to receive the streams issuing from the mountains sides.

Another Jaina statue in granite, of the same personage, though of inferior dimensions, occurs at Carculla, in Canara. It is said to be thirty-eight feet in height*, and to have been sculptured A. D. 1431. Both have hitherto escaped destruction, and possibly owed their safety to the superstitious feeling of veneration, which objects of great magnitude, wondrous art, or strange deviations from nature, rarely fail of inducing in the minds of all Hindus, without reference to caste.

I have already mentioned that the religious statues of the Jains are either in one erect or sitting posture: they are generally naked, and in attitudes betokening a state of repose, consistent with the metaphysical ideas entertained by this sect of a state of future beatitude; or of the profound abstraction and meditation on things divine, essential to the perfect attainment of that state. To this circumstance, superstitious adherence to ancient models as well as to the operation of the *beau ideal* of Hindu sculptors, which is highly unfavourable to the demonstration of the finer shades of anatomical development, and the expression of mind by its action upon the features, may be mainly attributed the tame and insipid character of their single statues, so odious to eyes that have been accustomed to look upon the exquisite productions of a Praxiteles, Chantrey, or Canova. The same causes prevented the Egyptians, from rising in the art of sculpture; who, we are informed by Mr. Wilkinson, even at the latest periods continued to

* One foot less than the celebrated statue to Minerva, of ivory and gold in the Pantheon at Athens, by Phidias.

follow the imperfect models of their early artists, and grace and feeling were for ever prevented from forming a feature of their sculpture: and though they made great progress in other branches of art, though they evinced considerable taste in the forms of their vases, their furniture, and even in some architectural details, they were for ever deficient in the combination of ideal beauty with the natural position of parts in the human figure. One great impediment to the advancement of the statuary's art in Egypt, was the unvarying posture of the figures, which were always in a state of repose, or in a position that only required the limbs to be straight, without any attempt at action, or indeed any indication of life: "all was made to conform to the same invariable model, which confined the human figure to a few conventional postures." Such are a few points of resemblance common to the productions of Jaina and Egyptian statuaries; which, had not a vile superstition pressed like an incubus on their rising improvement, would have anticipated in excellence and beauty the most exquisite sculptures of Greece. The Jaina statue now presented, was taken from the ruins of Bijanugger, and is doubtless that of *Pareswanath* from the attitude, contour, and serpent folds behind the back of the image. *Pareswanath* is the 23d *Tirt'hankar* of Jaina mythology, and is often represented with the cobra di capello canopying his head with its extended hood: not as a symbol of eternity, but from some circumstance connected with the history of this saint, recorded in his *pura'na.*

Subjoined is a list of Jaina MSS., now extant in the peninsula: which, if not already before the public, or among the Mackenzie papers, it would be advisable to procure copies of. The list was given me by a Jaina priest of Talicota, in the jaghire of the Mahratta chief, Rastia.

1st. The *Siddhanta Sastra* which proceeded from the mouth of *Ardenath* himself, the first of the last twenty four *Tirt'hankars,* written by *Gautam-Muni,* in the *Ghata Bhasa,* and afterwards compiled in Sanscrit, Canarese and Mahratta. This is considered the most sacred of their books.

2d. The Siddhanta Purána.

3d. Naga Komara.

4th. Herri Womshu.

5th. The twenty-four Puránas, of the twenty-four last *Tirt'hankars.*

6th. The Jaina version of the Ramayana.

7th. Vijaleng Purana.

8th. The Manter or St'hoter of Bhagwant, the Jaina ritual.

The *Hari Vansam* is equivalent to the *Mahavansu*, and is supposed to be a version of the *Mahabharat.* The *Vejaleng purána* is the history of *Vejala*, the Jaina king of *Kalyan*, and the rise of the Jangam sect. The *puránas* of the first twenty-four *Tirt'hankars* or deified saints, are not procurable.

VIII.—*On an error in Dr.* THOMSON'S *Mineralogy.—By Captain* J. CAMPBELL, *Assistant Surveyor General.*

In mineral analysis magnesia is one of the most difficult earths to precipitate. It has the peculiarity of forming a great many soluble double salts, and even its carbonate is partially decomposed by cold water, so that a portion is taken into solution. These double salts appear not to have been examined with sufficient attention by chemists; Rose in his Manual of Analytical Chemistry remarks that, in precipitating magnesia as a carbonate, carbonate of soda cannot with equal good consequences be employed instead of carbonate of potash,—carbonate of magnesia, according to Mosander, forms with carbonate of soda a double salt, this salt is decomposed, neither by boiling the solution, nor by evaporating it to dryness; while on the contrary the analogous double salt, containing carbonate of potash and carbonate of magnesia suffers decomposition thereby. The wash water also dissolves much more of the double salt containing soda, than of the simple carbonate of magnesia, yet, for all that, were carbonate of soda employed to separate magnesia, a great excess would be obtained in the analysis. Dr. Thomson says, "the employment of carbonate of soda, in-"stead of carbonate of potash, has also a tendency to prevent the for-"mation of the double salt, for soda-carbonate of magnesia, does not "form nearly so readily as potash-carbonate." The easiest, and readiest mode of precipitating magnesia, is from the ammonio-muriatic solution, by adding an excess of ammonia, and then adding phosphate of soda, when an immediate precipitate of ammonio-phosphate of magnesia is thrown down. This salt is almost insoluble in cold water, and therefore this method is the best, and readiest in a rough quantitative analysis, such as is desirable in the present state of our knowledge of our Indian minerals. But unfortunately we are precluded from using it, because chemists have not yet decided on the composition of the precipitate. Rose says that after being ignited, it contains 36.67 per cent

of magnesia, but Thomson says that it contains only twenty-two per cent. In this, however, it would appear, that Dr. Thomson has made a mistake, because he says that caustic ammonia, and phosphate of soda, also biphosphate ammonia, give the same precipitate; but this is impossible, because in using caustic ammonia and phosphate of soda, there is only *one* atom of the acid, which combines with one atom of ammonia, and one of magnesia, to form a subphosphate; and, after ignition, the ammonia having been volatilized, there will remain a neutral phosphate of magnesia, which, according to Dr. Thomson's table of atomic weights, will contain 35.7 per cent of magnesia, which is not much different from the proportion given by Rose. But if biphosphate of ammonia is used, in case the solution does not contain an excess of ammonia, two atoms of the acid will be present, one of which will leave the ammonia, and take up an atom of magnesia, and form a double neutral salt, and not a sub-salt as before. On igniting this precipitate, an atom of the ammonia being volatilized, there will remain a biphosphate of magnesia, containing 21.7 per cent of magnesia. We may therefore conclude that Dr. Thomson has been in the habit of using biphosphate of ammonia always as a precipitate, and that there are *two* insoluble double salts of phosphoric acid, ammonia, and magnesia. Dr. Thomson after giving the composition of the ammonia-phosphate of magnesia in his chemistry, remarks—"Riffault analysed an ammonia-"phosphate of magnesia, which would seem to have contained only "half the phosphoric acid in the preceding salt." It contained one atom of diphosphate of ammonia, and one atom of diphosphate of magnesia, which must be the very salt to which Rose alludes. I am informed that Brande, in his chemistry, mentions there are two salts of this kind, and one is composed of

Ammonia	1 atom.
Magnesia	1 atom.
Phosphoric acid	1 atom.
Water	5 atoms.

but between this Riffault's salt, there is a discrepancy—for this, Dr. Thomson says, is composed

1 atom.......	of.........	diphosphate magnesia.
1 atom	of	diphosphate ammonia.
5 atoms.......	of.........	water.

which is equivalent to

2 atoms.......	of	magnesia.
2 atoms.......	of.........	ammonia.

2 atoms.......of........ phosphoric acid.
5 atoms.......of........ water.

Therefore Riffault's salt contained only half the water that Brande's did.

There are points, which if cleared up would be of the greatest service to mineral analysis. How many there are in India, who have ample leisure to devote to such pursuits, and the apparatus required is quite trifling, and might all be packed in a bullock trunk. With all the activity of chemists in Europe, there is still a great deal of work to be done; there are many salts the composition of which has never been examined, and which require no very wonderful stretch of ability to analyse. Why then cannot it be done in India as well as in Europe. Mr. John Griffin, the translator of Rose, in a little work entitled "Chemical Recreations," which is in fact a most excellent treatise on operative chemistry, remarks that "No practical chemist, however young "he may be in the science, can pursue his studies with even a moderate "degree of zeal, without being enabled to add something almost daily "to the existing stock of knowledge. The variety of unrecorded facts "which continually strike the eye of an industrious experimenter is "indeed surprising." Again.—"The notion that a laboratory, fitted "up with furnaces, and expensive and complicated instruments, is an "absolute requisite for the proper performance of chemical experi-"ments, is exceedingly erroneous. In fact the truth is quite opposed "to this opinion."—"For general and ordinary chemical purposes" "says Dr. Henry "and even for the prosecution of new and important "enquiries, very simple means are sufficient: some of the most inter-"esting facts of the science may be exhibited and ascertained, with "the aid merely of florence flasks, of common phials, and of wine "glasses. In converting these to the purposes of apparatus, a consi-"derable saving of expence will accrue to the experimentalist: and he "will avoid the encumbrance of various instruments, the value of which "consists in shew, rather than real utility. It is a curious and in-"structive fact, that some of the most important discoveries in che-"mistry were made by persons who, either from choice or motives of "economy, used utensils of the very simplest characters. The labora-"tory of the great Priestly cost a mere trifle; and it is well known "how savingly Franklin went to work. The student will beware of "procuring the large and showy apparatus which strike his eye from "the lecturer's table, for they are useless to him." These remarks from a man of Mr. Griffin's practical experience, are encouraging enough to the chemist in India, and shew how true the old adage is. "Where there's a will, there's a way." The Laboratory of Dr. W. Prout, one

of the first chemists of the present day, was a carpetted sitting parlour; his laboratory table, a mahogany writing table, and his furnace the parlour grate.

IX.—*On preserving Timber, &c. from the destructive attacks of the White Ant.—By Aliquis.*

The well known effects of corrosive sublimate in protecting objects of Natural History from the attacks of insects, induced me to make a trial of its power of preserving timber, carpets, &c. from the destructive inroads of the white ant,—and I am happy in being able to say that the experiments I made were perfectly successful, and justify the hope that, by the means now recommended, we shall soon drive these destructive insects from our houses—or at all events render their visitations comparatively harmless.

The strength of the solution I used, was one ounce of the corrosive sublimate to one gallon of water, having previously rubbed the mineral up with a little alcohol to increase its solubility;—wood was immersed in the solution for one week, but carpets and cotton cloth were allowed to remain only for two days. The experiments I varied in every possible way—and uniformly obtained the same result, viz., that the white ant will but very partially, if at all, destroy the substance of any thing macerated in the solution, and that, on discovering its nature, they immediately disappear.

With woollen cloth the effects were less decisive, as the solution appears to be unable to penetrate the fibres of the wool, and is partially removed by washing—but under cotton carpets, rush mats, &c. the insects will burrow for the first day or two, and then disappear; and with regard to timber they are even more fastidious, as I have observed in their covert ways, that they had placed a coating of earth between themselves and the wood; evidently anxious not even to come into contact with the poison.

The advantages of preparing wood in the way recommended, are not, however, confined to its immunity from the attacks of the white ant—as it is now generally known that the same preparation (Kyan's patent) effectually resists dry rot, or other decay; and from the power it is known to possess, of coagulating the albumen contained in the wood—and indurating the fibres of the softer and cheaper varieties of timber, and

rendering them immediately fit for use, if cut down even in a state of active vegetation, are circumstances well worthy of public attention. The method, I believe at present adopted, for preserving the wood of public buildings from attacks of the white ant, is by the application of mineral oil; and its effects are but temporary, as it appears to depend upon its disagreeable odour—as it is only by the repeated renewal of the application that the wood is protected—but by using in its stead a solution of the muriate of mercury—no repetition of the process would be necessary—either to guard against the destructive effects of time, or the more sudden and injurious inroads of the white ant.

Its power over cloth is equally beneficial, and it has been found a perfect preservation against mildew.* As few tents become unserviceable from the simple wear and tear of use, I feel assured if the outer cloth alone, where the decay almost invariably begins, were steeped in the solution, it would, at a very trifling expence, add many years to its durability.

With reference to the question whether such an active agent, as we know muriate of mercury to be, could be so extensively used with impunity, and whether would it not, by becoming volatilized, impregnate the atmosphere of the rooms or tent with poisonous qualities, I am not able from personal experience to reply; but, from experiments which have been made to ascertain that point in England, I do not conceive that any injurious consequences would result from its use—more especially when applied to timber, cotton carpets or tent cloth, as the effects of the mineral upon both of these substances is to enter into chemical combination with them—and repeated washing in no ways diminishes its preservative power. In support of that opinion, I may mention that a vessel was built in England entirely of timber, prepared in the above way, with the sails and cordage also steeped in the solution, and that no inconvenience was experienced by the workmen in preparing the materials, or in building the vessel, or by the crew who inhabited her after she was finished.

The above remarks make no pretension to originality; the subject is one which has excited much attention in England, although I am not aware that it is one generally known in India. In submitting them I have been only anxious to give a knowledge of the facts more extended circulation, in a country where decay of property is so general and so rapid, from causes which muriate of mercury possesses the power of counteracting.

Madura, 1838.

* Vide *United Service Journal* on Kyan's patent.

X.—*Notes illustrative of the Geology of Southern India.—By Lieut.* R. Baird Smith, *Bengal Engineers.*

The universal prevalence of primary rocks, with the general quiescence of the agents of active reproduction, tend to give a degree of monotony to the geology of Southern India, and to deprive it of that interest which naturally attaches to activity and variety. The features of its hills and its valleys alike exhibit indications of the long continued reign of the decomposing and abrading powers of the natural world. The fantastic turret-like peaks, the results of the unequal disintegration of the granitic masses of which they are composed, so frequently crowning the summits of the one, are the trophies of ages of resistance on their part to atmospheric encroachments, while the boulder-like masses and crumbling deposits met with in the other, tell the same tale of long resisted but yet resistless power. But amid these signs of decay we see nothing of those active reproductive agencies which so abundantly characterise more diversified regions. No great rivers are seen bearing on their waters the fragments of one continent to re-create or increase another; no inland lakes or seas are gradually passing away from the face of the earth, year by year perceptibly approaching the time when fruitful fields will replace their "waste of waters," and when their solitude and silence will yield to the glad voices of the labourers rejoicing in the luxuriance of these new born lands.

Equally quiescent are all igneous agents, for no volcanoes are here in active operation, and the existence of subterranean forces is only occasionally indicated by slight tremblings of the earth within very limited districts. Yet even with this monotony, the geology of Southern India is not devoid of interest, since its very peculiarity in having been so long free from any powerful disturbing agents, either aqueous or igneous, has admitted of the full display of those phenomena which result from the unchecked sway of the decomposing influence of atmospheric agents. These are neither trivial nor uninteresting, since to this source there seems now but little doubt that the formation of the laterite, so long an apple of discord among the observers of Southern India, is to be traced. A mass of observations gleaned from many well developed lateritic localities, both on the coast and inland, have recently been made public in an interesting paper on this formation by Dr. Clark, H. M. 13th Dragoons; and by the careful examination and discussion of these, the question of its origin seems to me to be satisfactorily answered. Before this paper came to my knowledge, a conviction that

the laterite was the result of the aggregation of the decomposed constituents of the rocks which it usually overlies, was forced on my mind by observations in several of those identical localities whence I find Dr. Clark has gathered a considerable portion of his information; and it was with pleasure that I found a conclusion, based on limited data, supported by an examination so extensive and so ably conducted as that of Dr. Clark. In the vicinity of Bangalore, where both the lateritic and lithomargic formations are largely developed, an opportunity was afforded me of studying them in detail. Many of the protruding masses of sienitic granite and gneiss, which are the prevailing rocks, exhibit nature as it were in the simultaneous acts of decomposition and aggregation. Their surfaces are usually covered with a coating of dark coloured and weathered matter resulting from the felspar or hornblende, studded with small undecomposed and ferruginous pebbles of quartz, while round their bases the laterite forms a regular talus of variable size. It is usually of the compact quartzose and distinctly marked variety: sometimes however it assumes the cavernous or vesicular structure, the dark red matrix exhibiting a series of small cavities. One example was of peculiar interest, for, in consequence of the existence of a basin-shaped hollow in the side of the rock, the materials necessary for the formation of the laterite had collected there and a small nest of it formed. The circumstances of the case excluded from consideration both the aqueous and igneous causes, whose aid has usually been called in to explain the origin of laterite, and the clear evidence of its being due to the slow but certain operation of atmospheric agents amounted to demonstration. The bewildering effect of a multiplicity of contending opinions, gives to such simple yet well marked observations on the point at issue, additional value and interest.

As the resultants of decomposition, it is natural to expect that the character and composition of both laterite and lithomarge will be very variable, since the constitution of the parent rocks will necessarily influence that of the derivatives. Hence it has been found by observation that those rocks in which the proportion of quartz to felspar and hornblende is considerable, decompose into laterite, while those in which quartz is less abundant usually exhibit the lithomargic character. The same specimen sometimes presents both of these formations, the one passing imperceptibly into the other, and clearly establishing the position that they are effects of the same cause modified by concomitant circumstances. These circumstances are externally the variations of heat and moisture, and internally the greater or less degree in which the constituents of the rocks predispose them to be affected by the

oxidising influence of the atmosphere. Throughout nearly the whole of Southern India sienite prevails, and with it laterite is very generally associated. But sienite contains hornblende as one of its principal ingredients, and the large quantity of oxide of iron this contains peculiarly disposes it to yield to atmospheric action. Hence then follows the disintegration of the mass; the felspar furnishes the alumina necessary for the matrix, and the quartz resisting decomposition, and becoming ferruginous from the infiltration of the iron, forms the imbedded pebbles, and thus a laterite results. Dr. Clark from his own observations has subdivided the laterite into three classes, the lithomargic, the quartzose, and the detrital. The first is distinguished by the large quantity of lithomargic earth present in it, which deprives it almost wholly of tenacity, and gives it a cavernous appearance; the second, by containing numerous rounded pebbles bound together by a clayey cement, occasionally also cavernous; the third, by being merely a congeries of pebbles not firmly aggregated, but yet exhibiting the features of laterite. My own observations induce me to believe that this classification will include nearly the whole of the varieties of this very variable formation, as I have never met with any prominently beyond its range. To Dr. Clark's most interesting paper* I would refer those, who may wish to see the grounds, on which the present theory of the formation of laterite rests, fully illustrated; my sole intention in alluding to it having been to confirm the accuracy of his observations on those localities which we had similar opportunities of examining, and to contribute my limited store of facts for the elucidation of a point which has so long engaged the attention of geologists.

The depth to which the decomposing influence of the atmosphere will reach, even through the solid rock, is well exhibited when sections are exposed in excavations, an opportunity was afforded me for observing during the sinking of a shaft for a mine in the vicinity of Bangalore. The lithomargic earth commenced at eighteen inches or two feet from the surface, and, as the excavation proceeded, the sides of the shaft exhibited it beautifully variegated in colour. At about 15 feet it began to get slightly more tenacious, and the felspar appeared as white earth. Gradually to the depth of 20 feet, the rock approached nearer and nearer to its natural undecomposed state, though even at that depth it was still crumbling. When the excavation ceased at about 22 feet, the rock seemed to be pegmatie, as nothing but quartz and felspar were distinguishable, and, judging from its appear-

* Madras Journal of Science, December, 1838.

ance, the atmospheric action had probably reached a farther depth of 8 or 10 feet, making in all from 30 to 35 feet of solid rock penetrated by this destroying power.

It may be mentioned as an interesting fact, that the contents of the excavations in this vicinity were frequently auriferous, and small quantities of gold were obtained by washing. This is by no means an unfrequent occurrence in the Mysore country. In blasting sienite at Chinapatam, a village about 40 miles from Bangalore on the road to Seringapatam, I occasionally observed considerable quantities of gold disseminated in small particles over the fractured surfaces; and, at one time, in the vicinity of Wynaad, this metal was obtained from a rich yellow earth, in quantity sufficient to employ a number of labourers, and to yield some return.

Travelling eastward from Bangalore towards Oossoor, the country presents but little either of natural beauty or scientific interest. The beds of the nullahs occasionally exhibit a variety of laterite, whose formation seems to have been materially due to the transporting agency of water. The prevailing rock being the sienitic granite, its decomposition has supplied a large quantity of quartzy pebbles, which are strewed over the fields in every direction. A rush of water after heavy rains transports these to the adjoining nullahs, whose clayey bottoms form a matrix in which they become imbedded, and during the dry season the whole hardens into a compact mass, exhibiting the characteristics of one of the varieties of the laterite. Detached and water-worn fragments of the other varieties were occasionally met with, but no extensive deposits were observed in situ.

The hills in the vicinity of Oossoor were found to be composed of the universal sienite, exhibiting occasionally with the addition of mica the striated appearance of gneiss. Large veins of pure white quartz and dykes of greenstone traversed the main rock in different directions, without however having caused any alteration at the planes of junction. In many places the sienite had completely decomposed the hornblende into a dark red impalpable earth, and the felspar into a similar white one; the quartz was in ferruginous pieces, undecomposed, with highly vitreous lustre and splintery fracture.

Passing from Mysore into the Barramahal district, the primary rocks still prevail. The features of the adjoining country are now, however, altered, and the comparatively flat and uninteresting plain is exchanged for mountain scenery at once bold and beautiful. Lofty and precipitous hills rising abruptly from the plain, sometimes clothed with rich verdure and covered with trees and shrubs to their summits, at other times presenting scarcely one solitary green spot to relieve their desolate and

rugged nakedness, bound the view on every side, and the traveller, following the road which winds along their bases, passes through a series of valleys where, kaleidescope-like, each turning brings new beauties before him. On approaching Kisnagherry, the principal town in this district, the distant hills occasionally exhibit the ribbed-like appearance characteristic of columnar basalt. The town itself is overhung by one of these, but an examination of it, effected with considerable difficulty and risk, proved that the ribbed appearance was due, not to the existence of columns, but to linear deposits of earthy and fungoid matter, the dark colour of which, alternating with the natural colour of the rock, produced when viewed from a distance exactly the effect of a columnar arrangement. These deposits were formed along the lines by which little streamlets of water trickled down from the summit of the hill, these having doubtless led to the partial decomposition of the rock, and the formation of soil sufficient for the fungi to vegetate in. Nests of hornblende and greenstone were abundantly met with, and the whole of the sienitic mass was traversed by veins of pure quartz.

The cause of the constant occurrence in primary formations of these segregations of simple minerals in the rocks of which they form constituent parts, is a most interesting, but as yet unsolved question, and one attended with peculiar difficulties when experimentally investigated, from the circumstance that the phenomena in question require periods of such extent for their development, as to make it impossible to institute in the laboratory any experiments which would be strictly, and in all points analogous to what obtains in nature. In their original state of igneous fluidity, the operation of the attractive affinities of the molecules of which the different minerals forming granitic rocks are composed would be free and uninterrupted, as has been satisfactorily shewn by the "pyrochemical" experiments of Maesterlich, and others, who have succeeded in obtaining crystals of the minerals alluded to, from the igneous fusion of their constituents. But, the obtaining of these in their crystalline state, only as detached and individual substances, leaves us still in doubt as to the causes of some of them occurring massive and disseminated. Thus, among others, a curious and most interesting fact stated by Mr. Babbage in his "Economy of Machinery," appears to warrant the conclusion, that such segregations take place when the substances are in a state of aqueous fluidity; for he remarks, "Flints after being burned and ground are suspended in water in order to mix them intimately with clay, which is also suspended in the same fluid for the formation of porcelain. The water is then in part evaporated by heat, and the plastic compound, out of which our most beautiful

porcelain is made, remains. It is a curious fact, and one which requires farther examination than it has received, that if this mixture be suffered to remain long at rest, before it is worked up, it becomes useless: for it is then found, that the silex, which at first was uniformly mixed, becomes aggregated together in small lumps. This parallel," he adds, " to the formation of flint in the chalk strata deserves attention."* Could an analogous observation to this, on the aggregation of the constituents of minerals in a state of igneous fluidity be obtained, a most important light would be thrown on their occurrence in detached and massive portions in rocks of igneous origin. In the present, as in many other instances, geology must claim this boon from the sister science of chemistry.

At Mallepandy, a village about ten or twelve miles from Kisnagherry, a beautiful specimen of epidote, of the usual dark green colour, was found imbedded in a mass of true granite, which was here observed, though not to any considerable extent. The sienite was found to be peculiarly large grained, and the crystals both of the hornblende and felspar distinctly defined; on one fragment of the rock, which had been precipitated from the higher ground, a large quantity of iron pyrites in cubical crystals was observed. The country between this village and Wanianabaddy presents the same general features, veins of porphyry outcrop at about a mile from the latter place, exhibiting occasionally small nests of chlorite. The road in many places passes over the underlying granite, which is more abundant here than usual, and the large quantity of mica scattered over its surface causes it to glitter in the light of the sun like burnished silver. Many water-worn fragments of different rocks, greenstone, basalt, compact and vescicular, reddish coloured sienite, so small grained as readily to be mistaken for sandstone, are found strewed over the sandy plain surrounding Wanianabaddy. They are brought most probably from the distant hills by the Palar river, which during the moonsoon comes down with great violence, and often devastates the adjoining country.

The aspect of the valley between Wanianabaddy and Amboor is monotonous and uninteresting. At the latter place I was much interested by the marked development of the phenomena of crystallisation in the structure of the trap dykes, which traverse the neighbouring

* Note. Will carbonate of lime treated as above with alumina segregate similarly to silex? If it does, then may not the occurrence of layers of nodular kunkar in clay be explained on the same principle as the occurrence of like layers of flint in chalk? The question admits of an experimental reply, and an effort to obtain this is now in progress. R. B. S.

hills in great abundance. It is unnecessary however to describe these in detail here, as I have elsewhere done so at considerable length.* It may therefore suffice to remark, that the trap, invariably, on being fractured, exhibited cleavage planes, and separated into obtuse angled rhomboids; that fissures traversed the dykes always at right angles to the cooling planes or sides of the including sienite; that the direction of cleavage was perpendicular to that of fissures; and that the trap was evidently altered at its planes of junction with the sienite. In attempting to trace the cause of these phenomena we are carried to the unexplored domain of modern science, for their development is dependant on the action of molecular forces, whose origin and mode of operation are alike enveloped in much mystery. Mathematical analysis† has been successfully employed in demonstrating that, granting certain postulates, the phenomena of crystallisation may result from the adjustment of electrical forces; and observation tends apparently to confirm such a theory, by shewing that crystals do actually result from the action of forces derived from this source. But, we are still required to apply these conclusions with diffidence, as their verification cannot yet be considered as effected. The existence of electricity during the passage of trap dykes from their original state of igneous fluidity to that in which they now exist, may safely be concluded, from the experimental truth, that variation of temperature is one of the most fruitful sources of this agent; and should it ever be satisfactorily shewn that a subjection to electric agency confers on the particles of matter that peculiar polarity, which disposes them to group themselves in determinate figures, and under determinate laws, no element will be wanting for the application of such a principle of explanation to the present case.

The plain of the Carnatic is diversified by the occasional occurrence of connected, as well as detached hills. A peculiar feature is to be remarked in several of those in the immediate vicinity of Vellore. Individual hills are observed to rise abruptly from the plain, like islands in the midst of an ocean of sand, of the most perfectly conical shape, and wanting only the crater, with its accompanying cloud of smoke, to complete their resemblance to existing volcanoes. These hills are usually at some distance from the connected ranges, and as an explana-

* "On the crystalline structure of the trap dykes in the sienite of Amboor, &c. &c." Madras Journal of Science, July, 1839.

† M. Mosotti sur les Forces qui regissent la constitution interieures des corps Whewell's Hist. of *Induc. Science. Sommeville Conn. of Phys. Science.*

tion of the peculiarity, it might be conceived that the upraising force had in the one case acted on a line to produce the range, while to produce these insulated and conical hills it had been concentrated in a focus or point.

At Palleconda, a small town about 14 miles south-west of Vellore, I crossed a tract of country which has been described by Dr. Benza, an observer who has added considerably to our knowledge of the geology of Southern India. The plain on which the town stands is sandy, and strewed over it there are many weathered masses of sienite, which natural sections, afforded by the deep nullah beds, prove to be the underlying rock of the whole. Traversing this there are as usual dykes of trap and porphyry. The latter is of a peculiar kind, the porphyritic crystals being of felspar imbedded in a matrix of quartz. Investing a portion of this quartz-porphyry, were found crystals of an ore which I am inclined to believe was specular iron ore. Its characteristics were highly metallic, inclining to adamantine; colour dark grey, nearly black; hardness between 7 and 8; fracture splintery; structure laminated; specific gravity not numerically determined, but high; crystalline form a flat rhomboid. In the adjoining hills felspar of the sienite was occasionally of a pink colour, and dendritic on the surface. Transported masses of greenstone, basalt, mica, and clay slate were found in the vicinity of the streams, though none of these rocks were observed in situ.

The country between Palleconda and Vellore, while it exhibits no variety in geological structure, is interesting from the singularly wild and beautiful character of its mountain scenery. On the summits of the hills the tor-like masses of the sienite are grouped in the most varied forms, sometimes shooting up like spires, at other times strewed around like the ruins of some extensive edifice, or again standing square and solid, like the massive walls and donjon keep of some robber chieftain's tower. The valleys are covered with similar blocks piled on each other in the wildest confusion, the whole seeming to tell of mighty convulsions, rather than of the slow and scarcely perceptible operations of the agents of disintegration and decay.

A monotonous and uninteresting plain, with but little to attract the attention of the geologist, extends from Vellore to Madras. The same sienite which forms the distant hills underlies the whole of this plain, outcropping at several points. It was met with immediately under the sand during the progress of an artesian well sunk in the immediate vicinity of Madras, which after passing some little distance through the rock was abandoned; and indeed it is singular that, consi-

dering the geological configuration of the district, it was ever undertaken at all, since it is scarcely possible to conceive one less calculated for the success of such an attempt. The immediate succession of a close grained, hard, compact, primary rock of unknown thickness to a bed of porous sand, would effectually prevent the percolation of water to any depth exceeding that of the sand itself, and consequently the formation of those interior reservoirs on which the economical value of artesian wells depends. There are no porous strata beneath the sienite, nor is the sienite itself a cavernous rock like certain limestones in which water may collect in large basin-shaped hollows; hence the attempt must have been made with but little consideration of the principles by which such operations ought to be guided, and hence also an additional motive for the encouragement of the study of a science which promises to obviate such unnecessary expenditure of materials, money, and time.—*Calcutta Journal of Natural History, vol.* 1, *pp.* 188—199

Calcutta, *9th April*, 1840.

XI.—*Geological Features of the Himalayan Mountains.*

(*From* Royle's *Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part*).

Having noticed the extent and physical features of the Indian empire,* we might proceed to describe the materials of which its mountains and its plains are composed, as well as the soils produced by their disintegration. But the most cursory notice of the Geological features of so extensive a field would require more space than can be allotted to the subject; the Author must, therefore, confine himself to the part with which he is best acquainted, and which can be elucidated by his specimens and observations, which have attained some value from the kindness, as stated in the Preface, of his friend Mr. De la Beche. But the sections† can only be considered as giving a general idea of the dip, direction, and nature of the formations met with. The sections of the Himalayas correspond with that given, as far as it goes,

* In the "Introduction" to Professor Royle's *Illustrations*,—an abstract of which will be found at page 151 of No. 12 of this Journal.—Editor.

† "*Illustrations*," Plate 1.

by Dr. Falconer, in his Report on Tea cultivation, though he informs me that mine are erroneous; in the parts near the Snowy Peaks, where the Author relied for his information on Capts. Herbert and Hodgson, as, instead of consisting of gneiss, they are formed by one of the grandest outbursts of granite in the world. The sections of the Central range of India, from Sherghatty to Roghonautpore, formed by Mr. De la Beche, from the Author's specimens and observations, correspond with that previously published by the Rev. Mr. Everest, in 1831, in the third volume of the Gleanings of Science.

The great Gangetic valley consists of an extensive plain, which is very gradual in its slope from Saharunpore to the Sunderbunds, v. p. x. The structure is not easily detected, from the universal flatness, and the horizontal nature of the depositions, while water being near the surface, wells, the only works, reveal only a few feet in depth below. The surface soil is generally sandy, with a varying proportion of clay, which predominates in the substratum, and is in most places sufficiently pure for making bricks. Calcareous particles are intermixed with the soil and substratum in most parts. These in many places assume the form of spongy cavernous nodules: in some the form of stalactites or of roots, and are then apparently of modern origin; in other places they are in masses sufficiently large to be worked and used as a building stone. But the nodular appearance is the most remarkable, especially from the nodules being so abundant in some places, as to cover the soil, and give the appearance of the surface being covered as if with a fall of large hail-stones. This forms the extensively diffused *Kunkur* formation of India.

In Calcutta, in deepening a tank, a group of full-grown trees were found standing erect, and apparently lopped off, three or four feet above the roots. In boring for water, rubbish and mould were first met with, then sandy clay, and, at twenty feet, a vein of pure sand, the source of the common springs of wells. Blue clay, with sand,—then black, above a stratum of peat; with pieces of wood, that of the Soondree, and at sixty feet, Kunkur nodules; reddish well-sand at seventy-five feet, whence the river springs rise. Clays and sands, with some Kunkur, are found below this: a quicksand at 120 to 136 feet; and at 176 feet, quartzy sand and granitic gravel; and from 350 feet below the surface of Calcutta, the auger brought up a fossil bone, which is figured in J. A. S. for March 1837. At Benares, Mr. Prinsep, in cutting a tunnel and sinking shafts, found, fifteen feet below the surface, a number of half-quarried stones of a large size, on what he conceives must formerly have been the level of the ground; at thirty feet, some kunkur

was met with. At Saharunpore, in digging a well, after ten feet, coarse moist sand was found, mixed with round pebbles, chiefly of quartz, and about twenty feet from the surface, pieces of kunkur or tufaceous limestone, were raised, together with dicotyledonous wood, apparently of one of the Coniferæ. At Bihut, twenty miles north of Saharunpore, Capt. Cautley discovered the site of an ancient town seventeen feet below the present surface of the country. The Indo-Scythic Coins which had been entombed in this oriental Herculaneum, Mr. Prinsep refers to the commencement of the Christian era. Capt. Cautley is of opinion that the enormous discharge of sand, clay, and shingle from the lower hills during the periods of the rainy season, are gradually causing a rise of the country skirting their base, and to this and the action of wind on sand, he ascribes the inhumation of this ancient city. The structure of the plains may also be seen in the raised hills which skirt the base of the Himalayas, and the banks of the Jumna afford a very interesting series of sections, of which the structure may be treated of either with that of the Gangetic valley or of Central India, as some of the peculiar formations of the latter seem to extend even to the beds of that river.

Proceeding from the plains of India to ascend the Himalayas, we every where meet with a lower range of hills, which have been variously denominated " the Lower Hills, the Sandstone, Sub-Himalayan or Sewalic Hills." These hills, in many parts, rest immediately upon the Himalayas, but in others are separated from them by a series of longitudinal valleys. The part with which the Author is best acquainted is the direct road from Saharunpore to Deyra and the Himalayas, through the Kheree pass, which is the broad, generally flat, stony bed of a hill stream, ascending by degrees to the crest of the pass, now much cut down, but from which there is a gradual descent to the valley or Doon of Deyra. Along this pass flows in a winding course a small stream of very clear water. On either side, and about fifty yards apart, arise the hills, and, according to the windings of the stream, are seen sometimes sloping, sometimes abrupt; in the former case, covered with vegetation, in the latter, presenting a barren and precipitous display of their stratified structure. These strata dip to the N.E. or towards the Himalayas, at various angles from 20° to 38°, and the hills display every variety of appearance, partly from the destroying effects of water on so destructible a material, and partly to this being sometimes defended from its influence by a covering of a boulder stone. They are formed by a succession of parallel ridges, abrupt towards the plains, and sloping towards the Himalayas. In many places, each hill, if separa-

ted, might be represented by a right angled triangle, the base resting on the pass, the perpendicular facing towards the S.W., and the hypothenuse sloping towards the N.E., and corresponding in dip with the strata. This side is sometimes continued to the level of the pass; at others, another hill, with its perpendicular side, seems to arise from the middle of the last, and is itself, in like manner, succeeded by a third, forming a succession of abrupt and sloping sides, like the teeth of a saw. At Hurdwar, the sandstone character is complete, and the rock is sufficiently hard to be used as a building stone. About fifty or sixty feet were cut through to make a road between the river and the hills, by Capt. De Bude, of Engineers, at the back of whose house, on the Hill, rolled stones might also be seen lying upon the sandstone. These hills are composed of a series of clays, of a loose-grained sandstone, with much mica interspersed; beds of gravel and rolled stones, which consist of the debris of every variety of rock: as granite and trap-rocks, limestone and clay-slates, gneiss, micaceous and hornblende schists; in fact, of all the rocks of which the Himalayas are composed. Carbonate of lime is interspersed throughout the formation, forming stalactites and encrusting leaves, &c. Carbonate of soda is also found effloresced in many situations. In some moist situations the boulders are sometimes so soft, that quartz crumbles in the hands more easily than a piece of sugar.

The gravel and boulders found on these hills are very extensively diffused. They are abundant in the series of longitudinal valleys which are bounded to the S.W. by the Sandstone range, and on the N.E. by the Clay-slate formation of the Himalayas. These have been enumerated by Capt. Herbert as the Mokowala or Ropur, Pinjore, Kyarda, Deyra, and Patle, all between the Sutlej and the Gograh, and again, that of Chetuan, which lies to the north of Bettiah. They are from twenty to twenty-five miles in length, and of variable breadth, the widest being about fifteen miles. They have two outlets for their drainage, and their highest level is usually near the middle. The surface is level or undulating, intersected by ravines, or river beds; the rock is seldom seen, except on their boundaries. The soil of the Deyra Valley, in most of the uncleared parts, as well as in many of those long cultivated, is intermixed with these rounded pebbles and boulders, which are also found at great depths. In the well dug by the Hon. Mr. Shore, they were brought up from two hundred and fifty feet; but I observed that those from the greatest depths were angular, and composed of clay-slate and limestone similar to that of the nearest, or Mussooree range; but like the shingle of the Sandstone range, or that

found in the beds of rivers, they are usually composed of every variety of rock. Though so deep in the centre of the valley, the debris thins off towards its extremities, where the sandstone is seen underlying the beds of shingle; these boulders are also found filling up the valleys of the great Himalayan rivers, as those of the Ganges, Jumna, Tonse, Pabur, where flat terraces of considerable extent, sometimes cultivated, may frequently be seen, composed chiefly of great masses of boulders, with gravel and sand, with the river flowing at some depth below the flat terrace, and through which it appears to have cut its way. These exactly resemble the boulders in the channels of the rivers, or those found in the longitudinal valleys, or on the Sandstone hills, and may be traced, but smaller in size, to considerable distances: that is, to twenty or twenty-five miles in the plains, as may be seen in digging wells. They would be displayed in the same way as the Sandstone, or Sewalic range, if any portion of the present plains were by any means to be raised from their horizontal into an inclined position.

This Sandstone range may be traced along the plainward base of the Himalayas, from Roopur, on the Sutlej, to the foot of the Siccim Hills, in lat. 26½° long. 88½°, where it was recognized by Capt. Herbert, in his trip to Darjiling. Dr. Buchanan, in entering Nepal in long. 85°, describes the Hills as composed in general of clay, intermixed with various proportions of sand, mica, and gravel, disposed in strata, either horizontal or dipping towards the north, at an angle less than 25°, and that incrustations are abundant, from the deposition of calcareous matter, also lignite. The prolongation of these Hills from the Kalee to the Sutlej, or from long. 80½° to 76½°, has been minutely examined by Capt. Herbert, when employed on the Mineralogical Survey of the Himalayas, and their structure found to correspond with what has been described, and lignite found throughout. The dip is usually to N. E.; at Chikoom S. W.; but between Chilka and Dikoolee the beds are almost horizontal. At Hurdwar and Chandneepuhar, on opposite sides of the river, the strata dip in opposite directions. On the N. E. side of the Deyra Valley, in ascending to Mussooree, by Beejapore, I found the sandstone dipping S. W., at an angle of 25°, and at Kalsee sandstone is also observed dipping to the S., and gradually passing to a dip E. by N. Capt. Cautley has observed, that though we may, on a large scale, lay down the dip and direction with accuracy, the former as varying from 15° to 35°, and the latter from N. E. to. S. W., local details give very different results, and that near Nahun the mass of mountains have been upheaved from a variety of centres, as if the upheaving power had been exerted irregularly over the face of the district. He

has observed a section which gives an anticlinal point under the village of Derria, on the Murkunda river. My observations also give irregularity of dip in the mountains in the vicinity of Nahun.

The elevatory force does not any where appear, by which these hills have been raised from the horizontal position in which they must have been deposited, into their present inclined one; but Dr. Falconer and Capt. Cautley have both seen appearances of trap in the neighbourhood of these disturbances. My specimens and observations indicate its vicinity on the northward of Nahun; also in the vicinity of Kalsee, and in the ascent to Mussoree by Kuerkoolee. The nearest points to the southward where indications of trap are seen, are in the bed of the Jumna, and one of these is alluded to by Col. Sykes (Proc. Geol. Soc. Jan. 1832), when tracing the trap formation to the north, which I observed in a small island called Oudhar, below the village of Kuttea, and about three or four miles higher up the river than the Seeta Puhar, and about thirty miles above Allahabad, and therefore near Mhow, which is twenty miles below Murka, the two localities where volcanic rocks have been noticed by Mr. Dean, in the Journal of the Asiatic Society.

These hills have, however, in the last few years, attained great celebrity, from their containing one of the most extensive deposits of Fossil remains, which has any where been discovered, and which have been made public by several officers of the Bengal Army, whom I am proud to call my friends: as Dr. Falconer, my successor at Saharunpore; Capt. Cautley, Superintendent of the Doab Canal; Lieuts. Baker and Durand, of the Bengal Engineers, in a series of excellent Papers in the Researches and Journal of the Asiatic Society of Calcutta, and in the Transactions of the Geological Society of London. To the two former, this Society, the fountain of Geological honours, awarded two Wollaston Medals, in February 1837, for their discoveries in Fossil Zoology, especially as displayed in their description of the *Sivatherium giganteum*,* a huge Ruminant, which, they conceive, serves to fill up the blank which has always intervened between Ruminant and Pachydermatous quadrupeds, for it combines the teeth and horns of the former with the lip, face, and probably proboscis, of the latter. Lieuts. Baker and Durand are entitled to hardly less credit, for their Papers on the Fossil Horse, Hyæna, Bear, &c., and for having had the skill to detect, and for being the first to have the boldness to publish, in their Paper in the Journal of the Asiatic Society of Calcutta for November 1836, the dis-

* See No. 12 of the Madras Journal for a description and representation of this fossil. —Ed. M. J.

covery of Fossil Quadrumana. This was two months previous to the presentation, on the 16th January 1837, to the Academy of Sciences at Paris, of a Memoir, by M. Lartet, respecting the discovery of the lower jaw of an ape, in the tertiary fresh water formation of Simorre, Sansan, &c. in the department of Gers, in the south of France, and at the foot of the Pyrenees, and which in its genera so closely resembles that of the Fossil Sewalik Hills, found, it is curious, in the district of Sirmore. These dates are adduced, because Dr. Buckland, in the Supplementary Notes to his Bridgewater Treatise, has announced M. Lartet as the first discoverer of Fossil Quadrumana. It is highly creditable to the Bengal Army that the only four officers in that part of the country should each and all have so highly distinguished themselves, in a science foreign to the pursuits upon which they are employed by the Indian Government, but which they have treated so as to merit the applause even of those who have made Fossil Zoology the business of their lives, v. Mr. Lyell's Address to the Geological Society in 1837.

The discovery of Fossils in the Sewaliks is recent, and its history easily traced; but it is difficult to ascertain who first discovered them in any part of the Himalayas. The Gunduck has long been known to bring down Fossil Ammonites, which are called *Saligrammi*, and are much esteemed by the Hindoos. The Fossils represented in the upper part of plate 3,* from the elevated land on the N.E. of the line of Snowy Peaks, have also been long known in India by the name of *Bijli ke har*, or *Lightning Bones*, being employed by the natives in medicine. Capt. Webb and Mr. Traill were probably the first to bring them to the notice of the public; the specimens figured are from the collection of the Geological Society, having been presented by Mr. Colebrooke, to whom they had been sent by those gentlemen. The fossil shells figured in the lower part of the same plate,† are due to the researches of the late Dr. Gerard, who, I believe, first discovered them in the elevated valley of the Spiti, N.W. of Kunawur, though the date when, is not well ascertained; several, however, were figured at Calcutta in the Gleanings of Science for September 1831, where Capt. Herbert's paper on the Geology and Fossils of the Himalayas is published.

These fossils are all from the northern face, beyond what may be considered the true Himalayas. Nothing had then been discovered on the southern aspect of the mountains, with the exception of some at Caribari, in the small state of Cooch Behar, on the banks of the Brahmaputra, which were noticed by Mr. Colebrooke, in his account of the

* Illustrations. † Do.

Geology of the N. E. border of Bengal. But this point was so remote from the parts of the Himalayas usually visited, that it was long before it was discovered that they formed a true clue to the nature of the formations at the base of these mountains. The Author also, in December 1831, discovered some fossil fragments on the banks of the Jumna, which, though at first doubted, were afterwards proved to be such by chemical analysis, v. J. A. S., p. 457. Abundance of fossils have since been discovered there by the engineers employed in improving the navigation of the Jumna: v. papers by Capt. E. Smith, and by Mr. Dean, J. A. S. ii., p. 622, iii., p. 302, iv., p. 261.

Dr. Govan, in September 1831, discovered some Himalayan limestone which bore the impression either of a reptile or of one of the crustacea, which has not yet been described, but with this exception, nothing had been found on the southern face of the Himalayas, or from the plains to the Snowy Peaks, and yet diligent search had been made for fossils in the Sewaliks themselves, but chiefly from the Kheree Pass to Hurdwar, by Capt. Herbert, and by Mons. Jacquemont at Nahun and in the Kheree Pass, as professed geologists; by Capt. Cautley and the author in their occasional visits to the latter and to Hurdwar. Capt. De Bude of the Engineers, when cutting down the rock at Hurdwar, and the shingly summit of the Kheree Pass, had been requested to look out for any appearance of fossil remains; and one of the officers of the Engineers, who has since distinguished himself in such discoveries, almost threw himself upon what he conceived to be a deposit of fossils, when the police officer who is stationed near the head of the Kheree Pass came up and informed the party that a camel had died there in the previous year. Lignite had been discovered here, and described by Capts. Herbert and Cautley. To this the author projected a visit, before leaving that part of India, with Dr. Falconer; but, as time was wanting, the latter went alone, and "returned loaded, not only with lignite, but with noble fossils of the monsters of the deep; bones of crocodilidæ, fragments of the shell of large turtles, and a fragment of a bivalve shell as large as an oyster."—Journ. As. Soc., i. p. 97,—as announced by the author in some notes read to the Asiatic Society in February 1832, when he was led to inquire whether those fossils did not probably belong to the same formation as those discovered by Dr. Wallich and Mr. Crawford on the Irawady. No further progress seems to have been made until April 1834, when Dr. Falconer picked up the shell of a fossil tortoise in the Timly Pass; Capt. Cautley immediately proceeded to the Kaloowala Pass, where he had discovered the lignite in 1827, when Dr. F. recognized a bone, and in the course of

the digging, they found teeth of crocodiles; shells of tortoises; teeth, apparently of squalus; and bones and teeth of a pachydermatous animal, apparently Anthracotherium. The lignite lies between two beds of marl, or clay conglomerate; and in the upper of them the remains were found. Lieut. Durand, in September 1834, met with this marl, or clay conglomerate, on the north face of Nahun, with tortoise, Saurian, mammal, and fish remains.

But this discovery was eclipsed by that of the more extensive and important deposit of remains of fossil mammalia on the same range of hills to the westward of the Jumna, to which the duties of the Canal officers often led them. Attention was directed to this by Lieut. Baker having had given him, by the Nahun rajah, the fossil tooth of an elephant (Elephas primigenius) which had been picked up at Sumrotee, near the Pinjore valley. Lieut. B. proceeded to the Ambwalla Pass, on the western side of the Jumna, and found a large bone of some huge animal; Capt. Cautley, with his characteristic zeal, immediately joined Lieuts. Baker and Durand; when they carefully examined the ravine and slip, and brought away from the *upper strata of sandstone* seven fragments of bone, some of very large elephants, and the tibia, apparently, of a camel. A thin bed of blue clay, or blue marl, underlying the sandstone, and dipping at an angle of 20° to 30°, was found full of fresh water shells, as of Planorbis and of Paludina, v. Journ. As. Soc., iii. p. 393.* Specimens were also procured from other parts of the range, proving that from the Jumna to the Pinjore valley these mountains abound in fossils; and, in March 1837, Dr. Falconer announced the discovery of a few of the same fossils near Hurdwar, and in large quantities to the eastward of the Ganges in the low hills which skirt the province of Kemaon. Since then, the progress of discovery has been rapid, and is fully recorded in the works quoted. A more particular account of the localities, with sections of the mountains, is given by Capt. Cautley, in his paper read to the Geological Society (9th March 1836), and published in the Transactions, 2d Series, vol. v., p. 267, to which I gladly refer, and have only to give a brief enumeration of the genera and some of the species which have been discovered in the Sewalik hills. Capt. C. states particularly, that to the westward of the Jumna these hills are less abrupt; gravel beds are less frequent and abundant, and they are composed of varieties of clay-

* Though the Author refers to the Journal of the Asiatic Society, &c. as showing the publication of the information, yet he quotes chiefly from letters addressed to him by Capt. Cautley, and which are those referred to by Mr. Lyell in his address in presenting the Wollaston medal, in 1837, to the Author, to be forwarded to Capt. Cautley and Dr. Falconer.

slate, and quartz, which can be traced to the neighbouring and nearest mountains. He distinguishes the lower marl strata from the upper sandstone beds.

List of Fossils found in the Sewalik Range, *by* Messrs. Falconer, Cautley, Colvin, Baker, *and* Durand.

QUADRUMANA.

Three species of Quadrumana, v. Messrs. Baker and Durand, Jour. Asiatic Soc. Calcutta, Nov. 1836, Tab. 6, fig. 2; Messrs. Falconer and Cautley, J. A. S., May 1837. One allied to Semnopithecus.

PACHYDERMATA.

Elephas primigenius.

Mastodon elephantoides { M. *latidens*, Clift. — *Elephantoides*, Clift. }

——— angustidens.

Hippopotamus sivalensis, F. & C., v. Tab. 6. fig. a. b.

——— dissimilis, F. & C.

Anoplotherium posterogenium, F. & C.

Rhinoceros angustistrictus, F. & C.

Rhinoceros sivalensis, F. &. C., v. Tab. 6, fig. 4, a. b.

Anthracotherium silistrense, v. Tab. 3, fig. 12—15.

Chærotherium, F. & C., sivalense, F. & C.

Sus, (sp. undetermined).

RUMINANTIA.

Sivatherium, F. & C.

——— giganteum, F. & C., v. tab. 6, fig. 1, a., b., c., d.

Camelus (sp. undetermined: two undoubted).

Cervus, (sp. undetermined: numerous).

Antilope, (sp. undetermined: numerous).

Bos, (sp. undetermined: 1 new section in the genus), v. tab. 6, fig. 5, a. b., and fig. 6, a. b.

SOLIPEDA.

Equus Sivalensis, F. & C., v. Tab. 6, fig. a., b., c.

CARNIVORA.

Felis, (number, and character of species, undetermined).

Cats.

Canis, (species undetermined).
Bears.
Hyæna, (species undetermined).
Amyxodon, F. & C.
——— sivalensis, F. & C.

Indications of other Genera.

RODENTIA.

Hystrix, one, (sp. undetermined).
Mus, (species undetermined).
Castor.
Lutra.

REPTILIA.

Ghurial, (Gavial of Naturalists), or Leptorhynchus gangeticus.

Crocodile, (Muggur of Natives), or Crocodilus biporcatus, v. tab. 3, fig. 7 to 9. The head of a very large Crocodile.

Emys, (several species undetermined).
Trionyx, (several species undetermined).
Megalochelys, F. & C.
——— sivalensis, F. & C.

PISCES.

Heads, vertebræ, and scales, &c. of unknown genera and species.

Teeth of Squalus, v. tab. 3, fig. 4 & 5. Tongue of Raya? v. tab. 3, fig. 6, being the only appearance of marine remains.

TESTACEA.

Univalves and Bivalves, chiefly undetermined, but apparently—Unio, Cyclas, Cyrene, Paludina, Planorbis, Helix.

For detailed descriptions of these Fossils by the above gentlemen, see Asiatic Researches, Calcutta, 1836, Vol. xix., Part I., and Journal of the Asiatic Society of Bengal, No. 35, Vol. iii., p. 527; No. 45, 46, 48, Vol. iv., p. 495, 565, 706; No. 49, 53, 55, 57, 58, 59, 60, Vol. v., p. 38, 291, 294, 486, 579, 661, 739, 768, as quoted by the Editor of the Transactions of the Geological Society, Second Series, Vol. v., p. 278.

The Geological system of the Himalayas is extremely simple in the line of the sections, which are about fifty miles apart, and have been constructed from the Author's specimens and observations, commenc-

ing from the plains in both, extending to Kedarkanta in the one, and to near Shalma in the other. The formations may be treated of under the heads, 1st, of the Stratified, and, 2d, of the Unstratified rocks. The Stratified rocks consist of Clay-slate, with Limestone imbedded in, or alternating with it, and surmounted by a Quartz conglomerate, often called in India Greywacke or Grauwacke. Clay-slate continues for some time, and this is succeeded by Micaceous and other Schists and Gneiss. The Unstratified rocks consist of Trap-rocks and of Granite.

Stratified Rocks.—The Himalayas, between the Ganges and Sutlej rivers, like the Sewaliks, present towards the plains abruptly steep fronts, and a comparatively gradual slope in the opposite direction, from the strata dipping towards the north-east. As this is frequently repeated, we have a succession of steep ascents and sloping sides, with a deep valley intervening between two successive ridges, in which usually runs a small river, flowing either towards the Ganges or into the Jumna, or their feeders, or into those of the Sutlej. The drainage of these great rivers is every where separated by transverse ridges, which connect the parallel ridges, having the points of junction often projected into peaks, (*Illustrations,* Int. p. xvii). By proceeding along these ridges, we may penetrate far into the interior, without having occasion to descend into the valleys; but the mountain paths usually take the direct course, and we have thus a succession of ridges and of valleys to cross, and to experience great vicissitudes of climate, as well as a repetition of the geological structure and of the animal and vegetable forms which are dependant on this and on the climate. The plain-ward face being thus abrupt towards the south-west, has the solar rays falling on it more perpendicularly, and therefore experiences greater heat and dryness. The strata dipping towards the north-east, also produce, from their disintegration, a greater accumulation of earth on that side, while the springs following the natural slopes are more frequent on the north-eastern than on the south-western face of these mountains, and therefore the vegetation of the two sides varies much more than would be anticipated by any one who had not observed the difference (v. p. 16).

Clay-Slate.—In ascending the Himalayas, between the Ganges and Jumna, Clay-slate is invariably met with, of great variety of colour as well as of texture, and in many places most remarkably contorted, as at Rikikes, &c. below Surkunda Debee. In the ascent to Mussooree it is soft, variously coloured, and crumbling into small quadrangular pieces. At Mutrogh, below Budraj, near the spring which supplies water to the village, it may be seen of a fine texture, blue colour, nearly perpendicular, and easily splitting into large slabs, is used as roofing

slate. It may be seen of a still finer quality, and in still larger slabs on the ascent to Choor. In many places, nodules of quartz are seen imbedded in clay-slate, and in some places this is found passing into micaceous schist. Copper is found in it, in the neighbourhood of Khalsee.

Limestone.—In the ascent to Mussooree, alternating with the clay-slate, we find Limestone, usually compact and hard, but often honey-combed and cavernous, bluish in colour, passing to grey, whitish and chalk-like in some places, and becoming in others even black. It occurs first at Jureepanee, and then at the top of the range; it is also met with at Sahunsudhara, alternating with clay-slate and dipping east. It is found also in the Suen range, in the Kaphnul valley, as well as in that of the Riknal, and very conspicuously, and of enormous thickness, and over-topping the clay-slate, at Deobund. It is not, however, found constantly alternating with the clay-slate, even in the range which intervenes between the Jumna and Ganges rivers, as it is wanting near Budraj; also between Landour and Surkunda, though very abundant in the neighbourhood of Dhunoultee, one of the places which the Author recommended as an excellent site for a Sanatarium. The Limestone, though in such enormous, apparently amorphous masses, is rather partially diffused, when compared with the Clay-slate. Sometimes it is harder, and even non-effervescent, becoming also siliceous, and like chert; though the pure blue limestone, in connection with clay-slate, is the most common. In some situations it passes into beautiful calc spar, as at Dhunoultee; in others, into white saccharine Limestone, formed of large crystals, as in some places in mica slate and gneiss, as well near the granite of the Choor Mountain, and of Gungotri. Gypsum is found associated with the Limestone in some situations, as at Sahunsudhara, below Mussooree, and at Jureepanee, v. Herbert and Cautley (As. Res.) Heavy Spar, or Sulphate of Barytes, is found in the ascent to Landour, of which, as well as of the rocks, specimens were sent by the Author to the Asiatic Society in 1828. The sulphurous spring in the vicinity of Sahunsudhara, with the dripping rocks and numerous stalactites hanging down from the roof of the cavernous limestone, with the leaves, &c. encrusted with carbonate of lime, have often attracted the attention of, and been described by travellers.

Quartzose Conglomerate.—The Clay-slate formation is, in many of the peaks, surmounted by strata of a rock which Mr. De la Beche has denominated Quartz conglomerate. It varies much in appearance, being light grey coloured on Landour, coarse-grained and reddish on

Budraj, formed of rounded grains of quartz, and therefore usually called sandstone. This varies in appearance, but is usually found at the summits of the peaks, as on Budraj, Landour, and Surkunda, and even on Deobun, in thin isolated strata above the limestone. In other situations, it alternates with the clay-slate, and then, as described by Mr. Everest, " it becomes a distinct greywacke, consisting of a greyish green base, with numerous angular fragments of clay-slate imbedded. No such appearances could be observed in the slates which alternate with the Mussooree limestone; and this circumstance, coupled with that of super-position, seems to mark the quartz sandstone as the newest formation of the two."

Section No. 2.—The clay-slate met with in the interior is usually more uniform in appearance, especially in the line of the section, as on Tuen, where, however, it is much waved and crossed by veins of quartz, so on Acharanda and Jountgurh, and on to Bhok tibba. In the Khulan valley, clay-slate is alone found, and a precipitous slip shows the whole to be of uniform structure. At the head of the valley limestone is met with in masses; the dip is very generally to the N. E.

Micaceous and other Schists.—Mica slate occurs in ascending the south-western face of the Bhok tibba, though clay-slate forms the mass of the mountain, and is immediately succeeded by the mica slate and gneiss series. The clay-slate sometimes passes insensibly into what has been called quartz rock and even grauwacke in India, and in others into mica slate, which is, in some instances, fine grained and dark coloured, so as hardly to be distinguished from clay-slate. Mr. Everest, in proceeding from Mussooree, along the Ganges to its sources, mentions that quartz sandstone soon became the predominant rock, and that the slate had nearly disappeared, being only found in the lowest ground, opposite Ballahaut. The line of junction of the two was seen only a few feet above the level of the river. Somewhat before this, the slate had partly assumed the appearance of talc-slate, having a faint glimmering lustre and a soapy feel. Beyond Ballahaut, he continued travelling near the line of junction of the two formations, the slate gradually passing into a perfect talc-slate, and the quartzy sandstone becoming rather more crystalline than before. Perhaps the name of quartz-rock might be more appropriate to it, though it still exhibited, in some places, traces of round grains agglutinated together. About Batwaree, the quartz sandstone ceases on the low ground, and the slate contains a mixture of quartz and felspar, forming a talcose gneiss, with hornblende occasionally intermixed. Traces of the quartzy sandstone

yet remain upon the cliffs above, for some miles farther to the north, where a gradual passage of it may be observed into the talcose gneiss.—J. A. S., Dec. 1835, p. 692.

In the upper Section, No. 1, after the sandstones of the Nahun and Jytuk ranges, red marl, with veins of carbonate of lime, is seen in descending to the Julal river; and this is succeeded by the limestone and clay-slate series. About Booraree, mica slate, with crystals of hornblende, is met with, and iron pyrites in the valleys on both sides; mica slate succeeds, occasionally fine textured, and scarcely to be distinguished from clay-slate: in ascending to Phagonee, it becomes coarse-grained, and in some places abounds in garnets. Near Phagonee, a large vein of iron is seen, and some coarse-grained crystalline limestone; after which we pass to gneiss, before reaching the projecting masses of granite which form the summit of the Choor Mountain. Above Chowrass, a granite vein, running east and west, is seen crossing the mica slate. In descending, on the N. E. gneiss and mica slate, with garnets, are again seen. Near Chepal, iron ore occurs, and the slate becomes talcose in the bed of the rivulet, and a coarse plumbago slate is seen near the Soonth. The same formations are repeated in proceeding towards Changshill and Kedarkanta. In ascending to Bumpta, the slate becomes very quartzose, with layers of mica, occasionally assuming a granitic structure. On Urukta, mica slate, with garnets, is found, and often with nodules of quartz. In the descent by Deyra, the slate is met with containing grains of magnetic iron, in sufficient quantity to be profitably worked, and which has been named Hornblende Slate by Mr. De la Beche (Manual, 3d Ed., p. 435): it is associated with gneiss and mica slate.

Gneiss.—The system of slates is succeeded in the section by a more uniform formation of gneiss. The extent of which will vary according to our view of what is gneiss. Capt. Herbert calculated the gneiss to be of great breadth, forming a band of which the lowest point is 2,800, and the highest 25,709 feet high, thus including the lofty peaks and the snowy range; as he says: "The highest peaks are everywhere composed of gneiss, the strata of which may be clearly distinguished, when bare of snow, through a telescope. Granite has no where been found except in veins, and these veins are generally small, with one exception—Whangtoo on the Sutlej." In this Capt. H. was incorrect, according to the testimony both of Dr. Falconer and of the Rev. Mr. Everest (v. infra). " The gneiss is of very various character, as far as colour and grain are concerned, though always very regular,

consisting of the usual ingredients, united in the usual proportions; garnets, schorl, kyanite, carbonate of lime, green quartz, and hyacinth, are the most ordinary imbedded minerals. A speck of native gold has been found in a specimen from one of the granite veins."—*Gleanings of Science*, v. 3, p. 268.

Gneiss is found in many of the Passes, associated with chlorite and hornblende schists, as well as quartz rock, sometimes passing into micaceous schist; it is often found in the vicinity of granite, but is soon succeeded by micaceous schist, and this sometimes becoming talcose. The strata in general dip to the N.E., but great irregularities exist, and many instances are seen of their dipping in an opposite direction, but only to a limited extent.

Unstratified Rocks.—Trap-rocks, though frequently met with in fragments, were not until lately, recognized as forming a remarkable feature in the structure of the Himalayas. They were noticed by Capt. Herbert, and compared by him to Greenstone, as the schist in the descent to Khalsee, which he calls a Protean green slate, passing into a rock like greenstone. He also observes, that a trap-like rock is found in the vicinity of Bheemtal, and mentions a "Toadstone, of which the original mass is doubtless to be detected." But a vein of greenstone was discovered by Dr. Falconer in the neighbourhood of Mussooree, and the presence of trap-rocks has since been detected in numerous situations. Previous to this, the elevatory force was supposed to depend upon granite, which is revealed at the surface in so many places in Kemaon, and was supposed to be concealed under the surface to the westward of the Ganges, and raised to a great elevation only at the Choor Mountain. Hot springs abound in the Himalayas, and evidences of recent volcanic action were observed by Mr. Vigne in Cashmere, and have been seen by Dr. Falconer.

The igneous rocks, Dr. F. says, which have been found in the outer tracts, are of the green trap series, and are very generally met with in dykes, intersecting and rising through the regular strata, which are in all directions fractured or comminuted, and the limestone broken up into masses. The Mussooree vein is composed in some places principally of compact white felspar and pyroxene, and in others chiefly of hornblende, and may be traced for half-a-mile in a direction nearly parallel to the range of the mountains. Trap is also met with in one of the ascents to Mussooree, in the bed of the Jumna, and in the neighbourhood of Khalsee, and therefore abundantly displayed even within a limited extent. Mr. Everest mentions having crossed three different masses of greenstone in his journey from Mussooree to Gungotri: first,

on the ridge before descending into the valley of the Ganges, and two others in the clay-slate and talc-slate. He could not in either case trace their connection with the surrounding rocks, but infers that it probably crossed them nearly at a right angle, and if so, their range must approach to a parallel with that of the granite.

Granite.—From the foregoing extract from Capt. Herbert, the comparative absence of granite in the Himalayas might be inferred, though in the line of section a magnificent outburst is observed on the summit of the Choor Mountain, which is greyish coloured, coarse-grained, with veins of quartz, and is porphyritic towards Roundee. Enormous boulders of it may be seen in the valleys, both to the north and south. It was suspected to occur in other places, as boulders and hand specimens were well known and totally different in character from the Choor granite. Capt. H. was well acquainted with its existence in many places, as he says: " Granite displays itself on the southern face in several places, as at Champawut, Dhie, Almorah, Shaee Debee, Dooarahath, Pale dhore, Kunyoor, and Choor, situated, except the latter, in beds in a zone of minimum elevation, and a line passing through them all, has a direction to N. 60° W., the same as that of the strata and mountain range. West of the Ganges no such beds are found, but the granite occupies the summit of Choor; and this is the highest of the mountains of the southern slope of the Himalayas, excepting only those which form the snowy peaks and passes." In colouring these on the large map of the Himalayas they form a line beautifully parallel to the direction both of the Sandstone and the Himalaya range. On the higher belt and northern face, according to Capt. Herbert, and towards the central and highest parts, Granite veins are frequent, as at Whangtoo or Huttoo; and it is mentioned by himself, in his section of the Gonass Pass. But, notwithstanding this, he seems not to have recognized it at the sources of the Ganges, as Dr. Falconer writes me that " the section about the formation of Gungotri, instead of being of gneiss, is all, to the northward of Sookhee, purely granite, and most palpably so, a binary compound of felspar and quartz, with crystals of tourmaline. It is the grand granitic axis of the Himalaya, and one of the greatest and most magnificent outbursts of granite in the world." He went across the direction of it for many miles up the Bhaghiretty, beyond the temple at Gungotri, and saw no end of it. The granite escarpments shooting up into the highest peaks, and the huge cairns of granitic blocks, many of them as large as a house, he describes as inconceivably grand.

The Mines and Mineral productions of the Himalayas have been de-

tailed by the late Capt. Herbert, Superintendent of the Mineralogical Survey of the Himalayas, in a Paper in the Asiatic Researches, Trans. of the Physical Class, 1829, Part I., p. 227, and may be enumerated as Sulphur, Sulphate of Iron, Alum, Bitumen, Graphite, Gypsum, Limestone, Dolomite, Potstone, or indurated Talc. To these Calc Spar and Heavy Spar may be added.

Gold, in many of the streams, and specks of it in the Granite, near Kedarnath.

Copper, Grey Copper, and Copper Pyrites, and Green Carbonate.

Iron.—Red Oxide, Red Hæmatite, Micaceous, Scaly, and Specular Iron Ore, Compact Red Iron Ore, Magnetic Iron Ore.

Lead in form of fine granular Galena. Of the value of the mines we may expect a fuller account from the investigations of Captain Drummond, accompanied by his Cornish miner.

Kunawur and the northern face of the Himalayas. The Geology of this tract is little known, but we may expect a detailed account from the results of Mons. Jacquemont's investigations. Capt. Herbert, Gl. iii., p. 269, has briefly indicated its characteristics.

The Gneiss zone being stratified, and dipping at no great inclination to the N. E., the consequences to be expected are, that in proceeding to the north-eastward, the same succession of strata would be found, but at greater elevations. And this is the fact: although the development of rocks to the north is not equal in extent to those on the south side. Micaceous schist, with its associates, gradually gives way to grauwacke slate or grauwacke, which rocks are found at considerable elevations. Limestone, with organic remains, is found in beds in these rocks, and at such an elevation that the tertiary strata may be expected to occur at very great heights, and even the superficial deposits which have been called *diluvium.*

From the physical features of the country, the existence of tertiary strata might be *expected*, but these have been proved to exist by the Fossils, including the skull and lower jaw of a hollow-horned Ruminant (Antilope), that referred to by Capt. Herbert, Gl. iii., p. 270, with the tooth of a Rhinoceros. Those of the Horse, and Ox are also mentioned as having been found. The locality of these is not known, but Capt. H. concludes that they are from the northern face of the ridge which separates the basin of the Ganges from that of the Sutlej, and not far from the town of Dumpa.

The Fossils described by Dr. Gerard, Gleanings iii., p. 92, as found by him in a loose stratum of black schist, elevated 13,000 to 15,000 feet upon the declivity of the Spiti. The Terebratulæ were particularly remarked on the Laitche Lang Chain, the third great ridge of the Himalayas, at an elevation of 17,000 feet, altogether distinct from the above formation. From the examination of the shells, the Rev. Mr. Everest concluded that there exist in the Himalayan range strata analogous to the early secondary and transition formations of Europe; Gl. iii., p. 30. Specimens of the shells having been sent to Mr. J. D. C. Sowerby, he coincides in this view, and considers some of them as identical with shells of the mountain Limestone, Inferior Oolite, and Lias of England. J. A. S. 1., p. 248. The species in my collection, obtained chiefly from Dr. Gerard, consist of Astarte, a genus of which it is extremely difficult to determine the species. *Arca* or *Cucullæa*, Avicula, Terebratula or Atrypa, with a species not figured; a genus not determinable in my specimens: Delthyris? ; Ammonites, two species. The markings of both indicate that they belong to that division of the genus which range, from the Lias to the Chalk, both inclusive. Belemnites two species.

A section having been given of a portion of the Central Range of India, that is, from Sheerghatty to Rogonautpore, some details might be given respecting their Geological structure, but as the Author has already exhausted his space, he can only refer to the valuable papers of Dr. Voysey and of Colonel Sykes, as well as to that of Dr. Malcolmson, for the Geology of Central India, and to the Geological observations made by the Rev. Mr. Everest, on a journey from Calcutta to Ghazipore. Gleanings, iii., p. 129. The rocky basis of the range is composed of Gneiss, passing occasionally into mica slate; and that this alternates with hornblende rock, which is most conspicuous at the several Ghauts; and that they have both an anticlinal dip from the Granite and Trap, which make their appearance at the Suspension Bridge, and in the Bulbul rivulet. The Granite is also seen in outliers, and on both flanks of the range. On the Gneiss, a gray micaceous sandstone is horizontally deposited, but much disturbed in some situations. With the shale, &c. impressions of fossil vegetables are found, as well as Coal.

The Chinnakooree COAL formation, resembles that of Ranigunj, on the Damooda, described by Mr. Jones and the Reverend Mr. Everest, and noticed by Mr. De la Beche in his Manual, p. 399, from the Author's notes, but which he is compelled to suppress. Gneiss was seen near Pachette, but the hill over which the Author

passed was found to be composed of Red Sandstone and Conglomerate. The Coal is imbedded in shale, with loose-grained gray Sandstone, both above and below. See the above Authors, as well as Mr. Mc'Clelland's able report of "A Committee for investigating the Coal and Mineral Resources of India"* (Calcutta 1838), where the discovery of a raised beach of tertiary shells in the Kasya Hills is noticed, and a list is given of all the sites of Coal (and Lignite, as those in the Himalayas,) at present known to exist on the continent of India. They may briefly be enumerated as follows,—Burdwan, Ranigunj, Chinakooree, Adjai Seedpoorie, Paribarpoor, Darbadanaghat, Benares Road 149th mile stone, and other places; Hazareebagh, Rajmahal, Patsandeh Baghelpoor, Skrigully, Hurra, Palamoo, two principal beds, Amarath. Bidjegurh. Nerbudda, Towar river, Hoshungabad, Jubulpoor, Sohagpore, Chanda, Warda nala. Cuttack, Mahanadi. Assam Deuphapanee near Bramakoond, Namroop river, Suffry or Disung river, near Rungpore, Dhunsiree river, Jumoona river, Kossila river near Gowahate, Chilmari and Doorgapoor. Silhet, Laour and other sites, Kasya hills Chirrapunjie, Sarrarim, Manipur near capital, Gendah on Kuenduan river. Arracan Sandoway District, Kyook Phyoo Island. Moulmein, Anthracite at Bothoung. Southern India, Travancore, fossil seeds carbonized. Himalaya, Kemaon lignite, Moradabad, lower range. Indus, Cutch, Peshawur. To these may be added the indications of Coal discovered in boring to a depth of 400 at Calcutta and 300 feet at Goga in Gujerat.†

The Shales of Ranigunj and Chinnakooree contain abundant remains of Ranigunj Reed; *Vertebraria indica*, nob., and of another species, *V. radiata*, nob., *Trizygia speciosa* referred formerly to Sphenophyllum? De la Beche, Manual, p. 400, and mentioned by Mr. Jones as "impressions of flowers." This appears to belong to the natural family of *Marsileaceæ*, v. p. 431.‡ Of this new genus there is a second species found in Germany, and the Author has a third species lent him by Dr. Mantell, from the Anthracite of Mount Carbon, in Pennsylvania. *Pustularia Calderiana*, nob., *Pecopteris Lindleyana*, and *Glossopteris danæoides*, are the other plants obtained from the same locality. *Glossopteris angustifolia*, and *G. Browniana*, are other species mentioned by M. Adolphe Brongniart. The presence of the latter is re-

* Madras Journal, No. 20, p. 153.

† For an account of what has since been done in the search for this mineral, see a subsequent portion of this number.—Ed. Madras Journal.

‡ Illustrations.

markable, as it was originally found in the carboniferous series of Eastern Australia by Dr. Robert Brown, v. De la Beche, Manual, p. 401.

It would have been interesting to have concluded this cursory view of the Geology of parts of India with a notice of the various mineral resources of that country, which though little developed are very abundant, and some of which have long been known to, and formed articles of commerce to both the ancient and modern civilized nations of the earth, as the Author has endeavoured to prove, from p. 40 to 47, and p. 95 to p. 104, in his "Essay on the Antiquity of Hindoo Medicine, London, 1838."

XII.—*The Meteorology of the Plains and Mountains of N. W. India.* (*From* Royle's *Illustrations of the Botany, &c. of the Himalayan Mountains, Supplementary Part*).

Though the Meteorology of a country is frequently omitted in Works treating of Natural History, there is no subject which is more interesting or more closely connected with its several branches, especially when it is desired to point out the connection between climate and the vegetable and animal forms which it supports. This is still more important, indeed essentially necessary, when we desire to make any Practical application to the Arts of Culture of the results of our investigations into the Natural History of a country.

India being so extended in territory and varied in surface, with lengthened coasts, washed by a tropical ocean, and the summits of its mountains, covered by eternal snows, necessarily presents every variety of climate. As it is intended in the present Work to notice the vegetation of its heated plains and valleys, and to compare this with that found on the slope of its mountains, it is desirable, therefore, for the sake of comparison, to notice the more striking characteristics of the climate of different parts of India. This can only be done very briefly; but the Author hopes to be able to return to the subject, and give the details of his observations made at Saharunpore, from the year 1826 to 1830, with the Barometer, and both the Dry and Wet Bulb Thermometer, with observations on Radiation, Temperature of Wells, Quantity of Rain, together with Horary Observations, with all the instruments, from 1 A. M. to midnight, or for one day (the 15th) in each month for one year; occasionally also at different elevations, and at the different seasons of the year, in the Himalayan Mountains.

The instruments were compared with those of Captain Herbert and of Mons. Jacquemont, when these gentlemen passed through Saharunpore, and subsequently with those of my friend Mr. James Prinsep, on my arrival in Calcutta, and the differences between all were very slight.

As much of the vegetation of India is of a tropical nature, and as this is found extending into higher latitudes, or to considerable elevations, when local circumstances favour the production of a similar climate, we may therefore notice the characteristics of tropical climate, which consist in great uniformity of temperature, as well as of moisture, throughout the year. Various attempts have been made to ascertain by calculation the mean temperature of the Equator, assisted by the few observations which we possessed, of places in its vicinity. The illustrious Humboldt was induced to adopt 81° 5′ as the mean temperature of the Equator. Mr. Atkinson, on the contrary, inferred, that it was at least 84° 53′; but when it is considered that five-sixths of this line passes over the Ocean, the mean temperature of which between the limits of 3° N. and 3° S. varies, in general, between 80° 24′ and 82° 4′, and as the air which rests upon these waters is from 1° 8′ to 2° 7′ cooler, it is probable that 81° 5′ is not too low for the mean temperature of the Equator. Sir David Brewster, indeed, from observations since made in Ceylon, Penang, and at Singapore, is inclined to think that this may be too high.

The seasons in equatorial regions are well known to be characterized by great equability of temperature, and, in fact, they are not distinguished, as in high latitudes, into hot and cold, but into wet and dry seasons, and are greatly regulated by the periodical winds. In Java and Sumatra the thermometer seldom rises above 85° or 90° on the coast, falling as low as 70° at sunrise. The heaviest rains take place in December and January, the driest weather occurs in July and August, while the intermediate months afford variable weather. Singapore, from its insular nature, and being 1° 15′ North of the Equator, and near the S. extremity of the Malayan Peninsula, is well suited to give an idea of an Equatorial climate; there we have, fortunately, thermometric observations carried on for six years by Capt. C. E. Davis, three times a-day: at 6 A. M., 6 P. M., and at Noon (v. Journ. As. Soc. 2, p. 428), though the mean temperature deduced from them may probably be a little too high; but in the whole time the Thermometer never rose above 89°, or sunk below 71°, and the mean temperature deduced from the means of the extremes is 80° 04′ in all the years.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum....	84·5	85	87	87	89	88	88	88	88	88	86	86
Minimum....	70·5	73	72	74	75	74	74	75	75	75	74	74
	77·5	79·5	80	80·5	82	81	81.5	81·5	81·5	81·5	80	80=80·4

This degree of equability is found near the Equator only, but an approach is made to it during the rainy season of the year, both in higher latitudes and at considerable elevations, within the influence of the tropical rains, though the general characteristics of these situations is that of variableness of climate, or of a great range of the thermometer, both daily and annual. The result is the production, not only of great cold, but also of great heat, so that the thermometer is found to rise much higher at, and a little beyond the tropics, than in the neighbourhood of the Equator. This is accounted for, in some measure, by what has been observed by astronomers, that the sun, in his progress from the Equator towards the Tropic, advances in the first month 12°, and in the second 8°, so that at the end of the second month he is 20° from the Equator, and takes a month to advance the remaining 3½°, and an equal time to return, so that during the whole of this period the solar rays must fall nearly perpendicularly at noon on all places between 20° and 23½° of latitude, while a place situated under the Equator has the sun only during six days, as near the zenith, as the above places near the tropics have it for near two months; and, therefore, we may expect a greater degree of heat, which is moreover increased by the greater length of the days. The larger proportion of land near and beyond the tropic of Cancer, as well as the sandy barren nature of the soil, perhaps originally a consequence of, but now acting as a cause, in increasing the heat, together with the dryness of the air, all contribute, as causes, in increasing the absorption of, and the subsequent radiation of the heat imparted by, the nearly perpendicular solar rays. Thus Ritchie and Lyon state, that during whole months the thermometer stood at 117°, and at 128° in the Oasis of Mourzouk; Dr. Coulter mentions having observed it at 140° on the banks of the Rio Colorado, 32° 30′ N. lat., and we have it often stated as being 120°. Mr. Everest gives 111° as the highest at Ghazeepore; Mr. Prinsep as its being 114° at Benares. I have observed it at 107° at Saharunpore. The free radiation of the same open plains in the clear still nights of the winter months, causes a degree of cold which one is surprised to hear of as occurring in situations where the summer heat is so intense; hence the coldness experienced in some of the deserts of Africa, also by Lieut. Burnes, as well as in the plains of India.

The climate of many places in low latitudes has been ascertained, but of these we can only state the mean temperatures: as of places in Ceylon, from lat. 6° to 8½°; of Point de Galle, 81° 10′; of Colombo, 80° 75′; and of Trincomalee, 80° 56′; while the temperature of Madras, in lat. 13° 5′, has been ascertained, by numerous observations, to be 80° 42′. Pondicherry, on the dry and hot part of the Coromandel Coast, and in N. lat. 11° 55′, has the highest observed mean temperature, this having been found to be 85° 28′. Seringapatam, in lat. 12° 45′ N. long. 76° 51′ E., and elevated about 2,412 feet above the level of the sea, has a mean temperature of 77° 06′; the mean at sunrise is 63° 17′; at 3 P. M., 90° 95′; of the day, 84°; of the night, 70° 11′; the highest temperature observed was 115°, and the lowest 48°. At Bangalore, the mean temperature is about 74° 39′.

My friend Mr. James Prinsep, whose lamented illness all friends of science and of literature equally deplore, published, in the year 1832, the results of my observations, and as he has united them with others, I give his tables for the sake of comparison.

"The whole presents a convenient epitome of meteorological phenomena between 12° and 30° of north latitude. Of the climate of Madras, the minutest details are recorded in the voluminous and careful reports of the late astronomer, Mr. Goldingham, whose results merely required to be reduced to the freezing point. The Ava tables are abstracted from Major Burney's Registers, published in the 'Gleanings;' the Benares tables are taken from the Oriental Magazine, 1820; for the Saharunpore results we are indebted to Dr. Royle, who allowed us to look through his copious registers for the purpose. As the several barometers were never absolutely compared together, entire dependence cannot be placed upon the mean altitudes given; but with regard to Calcutta, Benares, and Saharunpore, as some opportunities occurred of comparison through the instruments of different travellers, the relative altitude of these places can be estimated tolerably well: thus, Saharunpore will be found to be almost exactly one thousand feet above the sea, as was before estimated by Captain Hodgson. Benares, in like manner, may be safely stated, in even numbers, to be three hundred feet above the sea.

MONTHLY DEVIATIONS *of the* BAROMETER *and* THERMOMETER *from their annual mean height at Calcutta; and at several other places, introduced for the sake of comparison.*

MONTH.	BAROMETER AT 32° FAHR.					THERMOMETER.				
	Madras, mean of 21 years from 1796 to 1821.	Ava, 1830.	Calcutta, for three years, 1829-30-31.	Benares, four years' observations, 1822 to 1826	Saharunpore 1826-27.	Madras, mean of 21 years' observations, max. & min.	Ava, 1830, sunrise and 4 P. M.	Calcutta, 3 years' observations, max. & min.	Benares, 4 years' observations, max. &. min.	Saharunpore 1826-27.
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January.......	+·146	+·229	+·208	+·273	+·274	—6·5	—13·7	—11·6	—17·0	—21.8
February......	+·131	+·115	+·172	+·175	+·219	—4·5	— 4·9	— 6·0	—11·5	—20.9
March	+·087	+·051	+·095	+·107	+·151	—1·8	— 2·8	+ 1·0	— 1·5	+ 0.1
April...	—·006	—·023	—·030	—·043	+·061	+0·7	+ 7·8	+ 5·1	+ 9·5	+ 6.1
May..........	—·124	—·105	—·152	—·136	—·060	+5·2	+ 5·6	+ 7·5	+13·9	+11.6
June...... ...	—·117	—·156	—·248	—·289	—·217	+7·4	+ 7·1	+ 5·5	+13·1	+17.5
July......... ..	—·103	—·176	—·218	—·308	—·398	+3·9	+ 4·4	+ 4·6	+ 6·9	+12.8
August........	—·088	—·126	—·194	—·203	—·278	+3·0	+ 4·1	+ 3·6	+ 6·4	+10.0
September.....	—·057	—·098	—·115	—·098	—·158	+2·1	+ 4·3	+ 3·7	+ 5·8	+ 9.5
October.......	—·018	—·010	+·020	+·074	—·047	+0·1	+ 2·2	+ 2·5	+ 1·3	+ 0.8
November.....	+·005	+·102	+·161	+·181	+·209	—3·1	— 4·2	— 5·4	— 9·7	—10.8
December	+·124	+·201	+·258	+·279	+·245	—4·9	—10·1	—11·5	—17·6	—13.8
Ann. mean..	29·810	29·573	29·764	29·464	28·766	81.69	78·39	78.13	77·81	73·5
Range.......	·270	·405	·506	·587	.672	13·9	21·5	19·1	31·5	39·3

" It will be remarked, that the range of variation in the weight of the atmosphere increases with the latitude, even up to the foot of the Himalaya Mountains, and that it is accompanied by a corresponding increase in the range of the thermometer.

" We now come to the *diurnal oscillation* of the barometer, for which the same sources have furnished me with materials for framing a comparative table for five localities considerably distant from one another; we could have added Moorshedabad to the list, but that the thermometric series for that place was incomplete. At Saharunpore the horary observations were confined to a single day, the fifteenth of each month; at Madras to three similar days; at Benares, perhaps, the hour of the minimum was not always exactly observed; thus a little irregularity must be expected, but on the whole the results are wonderfully equable.

DIURNAL OSCILLATIONS *of the* BAROMETER *and* THERMOMETER *at Calcutta, with Comparative Observations at other places.*

MONTH.	BAROMETER AT 32°.					THERMOMETER.				
	Madras, max. & min. every tenth day for 1823.	Ava, 10 A. M. and 4 P. M.	Calcutta, 9 40 A. M. and 4 0 P. M.	Benares, 9 to 10½ A. M. and 4 to 6 P. M.	Saharunpore, max. and min. of one day in month.	Madras, 4 A. M. and 2 P. M.	Ava, sun-rise and 4 P. M.	Calcutta, sun-rise and 2 50 P. M.	Benares, daily extremes by register thermom.	Saharunpore, extremes of one day in each month.
	Inch.	Inch.	Inch.	Inch.	Inch.	Deg.	Deg.	Deg.	Deg.	Deg.
January	·072	·144	·123	·097	·103	11·0	9·4	20·7	17·8	24·5
February	·070	·126	·117	·103	·093	10·0	16·8	18·5	19·2	21·0
March	·076	·107	·125	·121	·146	7·0	20·8	14·0	20·7	26·0
April	·081	·110	·124	·125	·107	9·0	20·9	14·6	23·2	31·0
May	·081	·113	·115	·124	·160	9·0	20·4	13·7	21·9	38·0
June	·092	·136	·095	·113	·178	9·0	9·0	7·6	16·1	31·5
July	·097	·133	·090	·077	·103	7·0	6·6	6·1	9·0	15·3
August	·105	·109	·099	·088	·079	7·0	8·8	5·9	8·3	11·5
September	·094	·145	·101	·103	·123	6·0	7·8	6·2	10·3	13·0
October	·068	·144	·110	·100	·120	8·0	5·0	8·4	18·1	31·5
November	·071	·127	·107	·107	·147	8·0	6·7	13·4	16·8	29·3
December	·071	·126	·114	·098	·124	9·0	8·5	17·1	16·3	17·5
Mean tide	·081	·126	·110	·105	·120	8·5	10·6	12·2	16·6	24·2

" With due allowance for the difference of sensibility in the instruments, the above table shews that the average diurnal tide of the barometer between the Equator and 30° north latitude, exceeds one-tenth of an inch, and that it is progressively greater as the variation of temperature during the day is also greater. With regard to the *nocturnal tide* of the atmosphere, the Calcutta tables afford us no data, for want of an observation at 10 P. M., the hour of the supposed maximum at night; all that is indicated therein is, that the barometer is constantly *lower* at sun-set than at sun-rise. At the Madras Observatory, in 1823, a series of horary observations was made for three days in each month, which seems to establish the fact of a night-tide beyond a doubt to the extent of .04 inch; when, however, the corrections for the temperature of the mercury are applied, this amount is reduced to two-hundredths of an inch, which is one-fifth only of the *diurnal tide.*

" The same result is obtained from a month's horary observations, undertaken by Col. Balfour, at Calcutta, in the year 1784. At Saharunpore, also, the existence of a nocturnal tide is equivocal: the following table exhibits all that we can gather towards the elucidation of the point in India, expressing by minus signs the real tide, or fall of the barometer, from 10 P. M. to 5 A. M., and *vice versâ.*" Mr. Prinsep concludes by saying, " There is still sufficient ambiguity respecting this

second tide, therefore, to render further inquiry necessary, and it would be desirable to employ a barometer for the purpose, which should not require to have any correction applied for the temperature of the mercury; this might be easily effected, by enclosing the barometer tube in an outer tube of the same length, also filled with mercury, upon the surface of which the scale might float."

NOCTURNAL OSCILLATION *of the* BAROMETER *from* 10 P. M. *to* 5 A. M. *reduced to* 32° *Fahr.*

MONTH.	Madras, three days in each month.	Berhampore, from Dr. Russel's tables.	Saharunpore, Dr. Royle's observations.	Vera Cruz, in Mexico, by Fray Juan.
January......	—·004	+·034	—·043	+·018
February.....	—·029	+·026	—·009	+·009
March........	—·026	+·069	—·008	—·002
April.........	—·027	+·008	—·007	+·003
May..........	—·014	+·020	—·020	+·005
June..........	—·026	+·012	+·039	+·003
July...........	—·009	·000	—·005	—·002
August.......	—·028	+·014	—·016	—·007
September...	—·024	+·011	+·011	—·012
October.....	—·033	+·009	—·004	—·021
November...	—·010	+·009	+·024	+·001
December...	—·019	+·027	+·015	—·023
Means...	—·021	+·020	—·001	—·002

Saharunpore, as we have seen, is situated nearly at the head of the great Gangetic valley, in N. lat. 29° 57′, long. 77° 32′ E., one thousand miles north-west of Calcutta, in the Doab, or space included between the Ganges and Jumna rivers, about twenty miles from the former, and nine from the latter, and about thirty miles from the Sewalik or Sub-Himalayan range of Mountains. It is celebrated as the station whence the Trigonometrical Survey of the Himalayas was commenced by Capts. Hodgson and Herbert (Illustrations, Introduction, p. xii.). It was then calculated by Captain, now Colonel Hodgson, to be elevated 1,013 feet above Calcutta. Mr. James Prinsep, from my observations, compared with his own, in Calcutta, calculated that my house, situated in the vicinity of the Botanic Garden, was as near as possible one thousand feet above the sea (Journ. As. Soc., vol. i. p. 29). The characteristics of the climate are mentioned at p. 7, of the Illustrations in connection with the vegetation, which is described as being tropical at one season, and partially European at another, and as having,

in consequence, an equally varied cultivation. To display this connection of climate with vegetation, it is desirable to give the temperature, so as to show the rise and fall of the thermometer; I have therefore thought it advisable to commence with the month of March, when increase of temperature takes place so rapidly. The thermometer was placed on the northern side of the house, but too near, for the extremes to be accurately observed, as, though the heat was probably greater, yet the cold was probably less, from the more confined radiation, as the minimum outside of a tent and not far from the house, was 27°, when the other was 38° 5′.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima.......	89	96	105·5	105	95·5	92	91·5	90·5	84	69	64·5	81·5
Minima........	47	62	67·5	73	76	78·5	64·5	57·5	45·5	44	38·5	45
Means........	68	79	86·5	89	86·75	85·25	78	74	64.75	56.5	52·5	63·25

Mean temp. ... 73·58

In connection with the thermometric observations at Saharunpore in the open plains of Upper India, it is interesting to give that of the Deyra Valley, in the same latitude, and about forty-five miles to the east. The observations were made by my late friend, the Hon. F. Shore, while Assistant Commissioner in the Deyra Doon.

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Maxima......	86	93	98	101	94	90	91	86	70	71	68	73
Minima.......	48	53	64	71	72	72	66	61	44	42	37.57	45
Diff..........	38	40	34	30	22	18	25	25	26	29	30·25	28
Mean.........	67	73	81	86	83	81	78.5	73·5	57	56·5	52·8	59·5=70·65

From the greater number of cloudy days, as well as from the greater moistness of the climate, it is found difficult to ripen some fruits which succeed in the plains, though others, as Bengal Plantain, Guavas, and several varieties of Limes, arrive at greater perfection. The greater degree of moisture must be ascribed to the surrounding mountains, and to the quantity of vegetation with which the uncleared parts of the valley are covered. Like other valleys, it is also more close, as the winds cannot blow so freely as in the open plains. The evenings and nights are, however, pleasant, as a cool breeze generally descends from the mountains, and at some seasons of the year the climate is delightful.

In the ascent of the Himalayas, in the course of the Geological section, Jurreepanee is a mid-way station, where I have occasionally taken observations, and of which the temperature feels cool to those who are ascending, but warm to those descending from, the mountains :

	Ther.	Moist Bulb.	Barom.	Merc.	Spring of water.
April 4, eight A. M.........	64	49.5	24.84	71°	63·5
Oct. 2, half past seven A.M.	62·5				
July 22, eight A M.........	68				65·5
" four P.M	79				

Mussooree and Landour are on the elevated range which rises immediately above the Deyra Doon, and where a Sanatarium for the recovery of the health of European soldiers has been established, as well as houses built by officers, and where I established a small nursery-garden, which was abolished by Lord William Bentinck, but re-established by Lord Auckland. The range enjoys a delightful climate, presenting as great a degree of equability of temperature from summer to winter, and from day to night, as is desirable. In summer the temperature is low, and all accumulation of heat is prevented by the coolness of the breeze which ascends from the valleys. The transition to the rains, which commence about the 15th of June, makes but little difference in the temperature, and the climate is remarkably equable; and though moist and usually cloudy, it is not otherwise disagreeable or unhealthy. In the month of October, or at the conclusion of the rainy season, and throughout November, the sky is so clear and serene, the air so mild and still, that the climate is perfectly delightful. The approach of the cold is so gradual, and its degree so moderate, as to be well calculated to brace the system, when improved by a previous residence in the hills. The coldest months are December, January, and February; in the last the greatest cold, and sometimes snow-storms, occur; after this, the rise in temperature is very rapid. Though 5,500 and 6,000 feet more elevated, the minimum, however, is very little lower than at Saharunpore.

The Author has already said, "that the cold of winter in these mountains, at least on the Mussooree Range, is not in proportion to the coolness of summer. It may be said, that with a winter temperature of their own latitudes,—that is, of the plains at their base,—they have the summer temperature of European countries; so that, without exaggeration, it might be said :—

Gurmush nu gurm ust,—	Its warmth is not heat,—
Surdush nu surd.	Its coolness is not cold."

The mildness of the night, compared with the coolness of the day, appears to be owing to the descent of strata of the atmosphere, which the heat of the day had caused to ascend. These, in descending to a

lower station, become more condensed, and thus having their capacity for heat diminished, give out a portion of their latent caloric, which necessarily prevents the sinking of the temperature to the degree it otherwise would, in consequence of the cooling effect of radiation from the surface of the soil. Favoured as this process is by the stillness and clearness of the night, its effects would be more perceptible, did not the breadth of the ridge bear but a small proportion to the mass of the air by which it is surrounded. This equability of temperature is observed, not only from day to night, but also from hour to hour, and from summer to winter.

One great anomaly presents itself in consequence of the still calmness of the mornings; for though the nights are pleasant and the mornings cool, yet, from the rapid rise of the sun, and the great power of the solar rays, the heat becomes considerable, and even insupportable in the open air, until a gentle breeze rises, and ascending up the valley, continues through the day, apparently following the course of the sun. The maximum of temperature frequently occurs at ten, or, at all events, the increase after that is so slight as not to be perceptible to the senses. In the plains we know the temperature of the air goes on increasing until 2 or 3 P. M. As the latitude is nearly the same as that of Saharunpore, the power of the solar rays and the quantity of heat communicated in a given time must be nearly the same; but in the plains it is allowed to accumulate: in the hills, on the contrary, the breeze which sets in daily from the plains towards the hills, and which commences about 10 A. M. (the very time after which so little increase takes place in temperature), passes over the top of the range, and prevents the accumulation of any heat. This breeze, though caused by the heat of the sun rarefying the dense air, at the surface of the earth, might be expected to arrive at the mountain top in the hot and parched state in which it rose from the heated plains; but the air as it ascends becomes still less dense, and in proportion to this diminution of density is its capacity for heat increased; so that it absorbs all the caloric which, in the plains, was sensible to the feelings, or was observed by a thermometer, and thus, on arriving at the top of the range, it feels cool and refreshing.* At night, a similar, but more gentle breeze, sets in from the hills towards the plains, and the two may, with the strictest justice, be compared to the land and sea breezes of the Coast and of Equatorial islands.

* These observations were first published by the Author in a Paper read before the Asiatic Society of Calcutta, and extracts published in the Journ. As. Soc., vol. i. p. 97.

As instances of the very gradual rise and fall of the thermometer from hour to hour, as well as of the little diminution of heat during the night, the following observations are subjoined, which were all carefully made in the open air, and on clear sunny days, but in the shade:—

Time.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
April 19	58	—	—	70·5	76·5	77	76	75	76	—	67*	69	—	—	—	—	—	—	—	60
,, 21	59	62	66·5	72	74·5	74·5	73·5	73·5	71·5	71·5	72	71·5	68	65	64	—	—	62·5	†	—
May. 6	53·5	58·5	63	68	75	75	75·5	76	75·5	72	66*	70	69	—	64	—	—	58	—	—
Sept. 29	57	59	60	61	—	69	—	69	—	—	—	66	—	—	64	—	—	60	‡	—

The transition to the rainy season is not accompanied with so great a diminution of temperature as might be expected. In the year 1829, the rains came on on the 15th of June. The mean temperature of the two previous days were 67° and 68°, while that of the twenty-four hours subsequent to the rains was 62°, and that of the whole day of the 16th was 63·5

A thermometer hung up in the sun, and freely exposed to its influence, as well as to that of the air, was usually from 5° to 10° higher; the maximum generally taking place about 12.

Atmospherical pressure is also very equable; but the observations have not all been made with a stationary instrument, nor all at the same place in the hills. At the top of the range, where the houses were first built, the barometer observed in September, October, December, and April, did not differ at these various times more than one-tenth of an inch, or from 23·60 to 23·50. Mr. S. Boulderson has published his observations in another part of the same range, called Caineville, from 15th May to 21st of November: he has 24·158 as the maximum mean of seventeen observations, from 1st to 21st Nov., at 10 A. M., while 23·815 is the minimum of twenty-two observations in June, at 4 P. M., giving a range of ·343 inches.

The daily periodical fluctuation was observed to be as regular in the hills as in the plains. The maximum height to which the barometer rose was always about ten o'clock, and the lowest to which it fell, about 4 P. M.

From the equability of temperature as well as of pressure, we might also expect considerable equability of evaporation; but if it were not for the increased capacity of air for moisture, as well as for caloric, in proportion to its rarefaction, the climate would be a very moist one, as, indeed, is the case in the rainy season. From my observations, however, it appears, that there is always a moderate degree of evaporation

* Cloudy. † 57·55 next morning. ‡ 56 next morning, at day break.

in the Mussooree climate; the greatest difference, or 20°, between the dry and moist Bulb Thermometer, occurred on the 6th May; on the same day, the difference at Saharunpore was 32° 5′. On the 5th April, in the morning, after rain, the difference was 7° 5′, while at Saharunpore, on the 7th, also after rain, the difference was only 3° 5′. Even when enveloped in a cloud on the Mussooree range, I have found 2° difference between the dry and moist thermometers, and on cloudy days the difference varied from 4° to 10°. Also at the conclusion of the rains, that is, on the 29th September, the mean of the differences on the Mussooree was observed to be 7° 7′, while at Saharunpore it was only 6° 7′.

The meteorological phenomena observed in the years 1827 and 1828, have been reduced to a tabular form, which will give a good general idea of the nature of the climate, as they nearly correspond with those observed in subsequent years; but the peculiarity of seasons, their greater dryness or moisture, later accession of the rainy seasons, or the total absence of a snow-storm, in some years, will, of course, here, as elsewhere, modify the temperature of particular months.

RESULTS *of* METEOROLOGICAL OBSERVATIONS *at* MUSSOOREE.

MONTH.	Means of all the Observations.	Maximum during each Month.	Minimum during each Month.	Means of Maxima and Minima.	Increase and Decrease of each Month.
	°	°	°	°	°
January........	42·45	51·5	34.5	43	—2·55
February.......	45.42	63	27	45	+2·97
March..........	53·63	69	37	53	+8·21
April............	59·83	77	41	59	+6·2
May.............	66·01	78	41	59	+6·18
June.............	67·12	74	61	67·5	+1·11
July..............	67·35	71	63	67·5	—0·23
August..........	66·43	69	63	66	—0·92
September......	64·04	69·5	57	63·25	—2·39
October........	57·25	66·5	48	57·25	—6·79
November......	50	57	48	52·5	—7·25
December.......	45	55	29	42	—5·
Mean Temperature of the Year.	57·04			56.5	Mean Temperature of the Year from the Monthly Maxima and Minima.

XIII.—*Report of the Coal Committee.*

In submitting a summary of what has been done since our last Report, we shall commence with the

Tenasserim Provinces.

Coal has been found in the Tenasserim provinces by Dr. Helfer in two situations above the falls of the Great Tenasserim, at a distance of eight and nine days' journey, respectively, from the town of that name, but the quality is inferior, and the situation quite beyond the reach of any mode of conveyance to the coast.

Although the quality is excellent in a third situation in which the mineral has been found by Dr. Helfer, yet its distance from the coast is such as to render it of very doubtful utility on the Bengal side of the peninsula, whatever benefit it may eventually prove on the Gulph of Siam, as it seems to be situated beyond the boundary range of hills. Fortunately a still more recent discovery by a native, places us in possession of what would seem to be a most excellent coal, close to the banks of the Great Tenasserim river, and within twenty-nine miles of the town of Tenasserim.

Two reports have been addressed to the Commissioner of the Tenasserim provinces on the last mentioned coal, one by Lieut. Hutchinson, dated 6th May 1839; and the other, of a somewhat later date, by Dr. Helfer. From Lieut. Hutchinson's report, we learn that the position of this coal is 12° 21′ 30″ N. lat., and about 99° 5′ E. long., or, by the course of the river, twenty-nine miles from the town of Tenasserim, and sixty-five from Mergui, although its direct distance from the coast is only twenty-eight miles. The coal is said by Lieut. Hutchinson to form a thick bed, covered by three feet of "*clay slate,*" and from twenty to forty feet of *sand, which is so tenacious* as to require no propping where springs do not exist. In a subsequent correspondence on this subject, the coal is described as within ten feet of the surface, and from all we can learn, we have no doubt it might be worked like crop-coal, and clay ironstone, as described by Mr. Farey, i. e., merely by sinking pits down to the coal and raising it at once, and after undermining on all sides as much as can be done safely by the use of props, the latter may be withdrawn, and the roof allowed to fall in.

This coal burns with a bright flame, and answers admirably for steam purposes. Fifty pounds tried in the still furnace laboratory of the

Honorable Company's Dispensary, afforded four gallons of distilled water, and left a residue of four pounds weight of ashes, cinders, and small coal that fell through the bars of the furnace during combustion.

Its specific gravity is 1·27

Composition,

Water,......................	9
Volatile matter,...........	46
Carbon, ...	40
Ash,.........................	5
	100

The distance of this coal in a direct line from the coast being only twenty-eight miles, Lieut. Hutchinson proposed to construct a road, which he supposed would reduce the expense of delivery on the coast considerably. Boats of large draught it is said, may ascend the Tenasserim river at all seasons to Tenasserim town, within twenty-nine miles of the coal, and during the rainy season to the coal itself, so that nothing could be more favourable than the position of this coal for all purposes of local improvement, as well as for steam navigation to the eastward. Forty tons of this coal cost 5½ annas per maund at Mergui, and 8 annas per maund in Calcutta. The Government have called upon Mr. Blundell, the Commissioner of the Tenasserim provinces, to provide 50,000 maunds; and have furnished a working party, consisting of persons accustomed to mining, for the purpose, and have intrusted the superintendence of the necessary operations to Lieut. Hutchinson.

We have been informed by Captain Lloyd, I. N., that about one degree lower down the coast, coal has been found of very good quality on the *Senhea* river, but the Committee have no information on this head, although some progress had been made in raising a quantity, when the work was discontinued in consequence probably of the more favourable position of the coal near Tenasserim. The Senhea coal is situated, Capt. Lloyd thinks, about 11° 22′ N. lat., and 99° 8′ E. long. about forty miles up the river, the navigation of which is doubtful. It is however the most southern point at which coal has been hitherto found on the Malay coast.

A detached fragment of an inferior coal called Anthracite by some, has been found near Maulmain, latitude 16° 30′ N. thus indicating the presence of coal formations between the Tenasserim coal fields, 12° N. latitude, and Arracan 19° N. latitude, and holding out strong inducements to further search being instituted in that quarter.

Arracan..

The more we know of coal, the more are we impressed with the fact, that it never presents false indications of its presence. There is hardly an instance either in India or elsewhere of its appearing at all, that it does not do so under circumstances to render it in the highest degree important to Society; and although at first the quality and extent of the beds in any new district may be for a time doubtful, yet experience teaches us, that where these indications do not improve in proportion to the intelligence and enterprise directed to their complete development, the mineral is not true coal, but a substance, the peculiarity of which is easily detected, as the brown coal of English geologists. The samples of coal we received from different parts of the Arracan coast, were such as to leave no question whatever as to the beds from which they were taken belonging to the true coal formation.

Coal has been found composing a part of Oogadong, a small island opposite to the harbour of Kyak Phyo, in two situations not very far from each other. The sample supplied was much impregnated with pyrites, it was however a caking coal, belonging to the true coal measures. It would be a desirable object to try how far the Oogadong coal might answer for the reduction of Rambree iron ore, which is very abundant. Red Hill being said to be composed entirely of an ore that was formerly worked to some extent by the Burmese, a small quantity of the ore and coal might be sent to Calcutta for trial, and if the result proved satisfactory, trials on a larger scale might be repeated on the spot, where experiments of the kind must always be cheaper and more satisfactory than when made at a distance. Coal has also been found on Paget, or Adam's Island, south of the great island of Rambree. It has also been found in small seams in one of the Bolonga Islands, as well as near the beach at Sandoway; but the necessary information is wanting to enable us to conclude any thing from these indications, beyond the fact of the existence of coal, to a great extent, in the Arracan provinces.

The most promising bed yet found, is one that was brought to the notice of the Commissioner, Captain Bogle, by Lieut. Lumsden, who states that it was found about two years ago by persons employed in coal-finding by Captain Williams. This coal occurs at a place called Hoong, near the head of a river, which descends from a range of hills on the southern extremity of the island, falling into the Sandoway channel. Mr. Lumsden states that large boats may approach to the very spot where the coal is found. On visiting the spot, Mr. Lumsden found " an irregular vein of coal, of about a foot in thickness, mixed

with broken red sandstone, and on working below it, he came to a kind of *clay-slate* and eventually to water." Mr. Lumsden, however, states that he was obliged from fatigue to leave the work to a native, who in a few days brought to him 120 maunds of coal—a larger quantity than we should have supposed a native could procure in so short a time, under circumstances described by Mr. Lumsden. A sample of this coal, consisting of four or five maunds, was brought to Calcutta by Captain Bogle, and tried in the Laboratory of the Honorable Company's Dispensary, and found to burn with a clear bright flame and very little smoke. The following are the results of its analysis :—

Specific gravity, ...	1.28
Inflammable matter, ...	40
Carbon, ...	54
Ferruginous ash, ...	6
	100

It is a free burning coal, giving out a strong heat, and would no doubt be found suitable to steam purposes, as it is quite free from the sulphureous impregnation which rendered the former samples of Arracan coal objectionable.

The want of more satisfactory information than we yet possess regarding Arracan coal is much to be regretted, as there is no part of India in which good coal mines could be attended with more advantage, whether we regard the situation on the coast, or the peculiar circumstances of the province itself. This district is chiefly known to Europeans by the mortality that took place there during the late war. Few are aware that within twenty miles of the town of Arracan, there is a fine elevated chain of mountains, extending parallel to the coast, and affording no doubt as fine a climate as any part of the world, although the coast itself is low, and like many similar tracts in the north of Italy, and south of Europe, unhealthy. Let good coal be once discovered in abundance in this fertile province, and the deadly effect of climate to persons exposed in miserable boats, or damp huts surrounded by swamps, will disappear, and the indolent streams become the track of steamers, perhaps to the very foot of the hills, which might thus become available as places of residence.

Sylhet.

Although the attention of the Coal Committee has been constantly directed to this quarter, the only result accomplished since the last report, that can be said to be new, is the delivery of 10,000 maunds of

Cherra coal at Goalparah, in Assam, at the rate of eight annas per maund,* after the attempt to supply that station during the rainy season with coal at any price from Burdwan had failed.

Three beds of coal, situated near the foot of the hills, have been brought to notice, but we have no information on the subject to enable us to decide whether these are new discoveries, or merely the bed alluded to in our last reports, as having been brought to notice some twenty-five years ago by Messrs. Jones and Stark. Without going into that question, we shall merely state all we know of the three beds now alluded to.

The first and most promising, is that of Byrung Poonjie,† situated near a village of that name, within about two miles of water carriage, and the ground such as to allow of the construction of a hackery road.

We know nothing of the circumstances of the bed, further than is stated by Mr. Landers, a practical gentleman, who has been appointed for the superintendence of coal mines in Sylhet and Assam, and who observes—

" Byrung coal is of a soft quality, intermixed with stones three feet and a half high and varying in its thickness. The vein runs from east to west, and descends with the hill towards the south: to what extent this field may exist, it is impossible at present to say, the want of proper implements" (these have been since provided) " prevented me from ascertaining; a trial ought to be made by running galleries into the strata six or eight fathoms, at once to determine both height and quality, and also if it would admit of any outlay." This coal has been tried, and appears to be likely to answer very well for steam, while it has the additional advantage of yielding excellent coke.

Not far distant from the Byrung bed, there is another at a place called Chiela, or Chaila, which varies from one to three feet in thickness. This however is said to be an inferior coal.

Major Lister, to whom we are indebted for the first and almost the only information we have had regarding the two foregoing coals, states, that Mr. Inglis, of Cuttack, has found a coal bed above Chaila, at a village called Mustuk, above 1,500 or 2,000 feet above the plains, and within such distance of water carriage as to enable a porter to deliver five burdens daily from the pit into boats. Mr. Inglis is of opinion

* This having been done under the direction of the Marine Board, the Committee have documents on the subject.

† Communication has been received from Major Lister since the annexed remarks were written, stating that Mr. Landers has traced the Byrung Poonjie bed for two miles to the westward without finding more on an average than a foot of good coal; hence Major Lister and Mr. Landers conclude the Byrung bed is not workable.

that this coal is quite as good as that of Cherra,* and Major Lister observes that it looks so, though the quality is different, being blacker, with an exceedingly high polish; it burns considerably longer than Cherra coal, and cakes less, but is heavier, and yields more ashes.

The value of these, as well as similar indications alluded to in our last report, is still doubtful, and must remain so until the whole tract along the base of the Kasyah hills be submitted to a geological survey. For the present season, if the Government require coal from this quarter, we agree with Major Lister in thinking it will be necessary to confine our exertions exclusively to the Cherra bed. This, as is well known, is situated on the summit of a mountain, nearly 5,000 feet above the sea, and at such a distance from navigable rivers as to render it a day's work for each cooly to deliver a maund, or about 80 pounds, of coal from the pit into a boat.

The only way of lessening this inconvenience would be by improving the conveyance, by an improvement of the road. Above and below the steepest portion of the descent would admit of bullocks being used. Instead of porters for the steeper or middle portion of the journey, it has been proposed to construct a slide, as suggested by the late Colonel Watson. The improvement of the road between Cherra and the plains would be a work of some public utility, as it would be the means of facilitating ingress and egress to and from the mountain plateau, it would therefore be a very desirable object, independent of the coal. The value of a slide however, would depend entirely on our success in finding as good a coal below, as that which is above—an uncertainty which ought to be at once removed by a perfect geological survey, as already suggested.

Some difference of opinion prevails as to the best way of transmitting Sylhet coal to the great lines of inland navigation on the Ganges; some contending that it would be necessary in the first instance to send them a distance of 300 miles to Calcutta, and from thence back to Surda, and other depôts on the Ganges;—experience is the only way of settling questions of this nature, and measures are now in progress for the delivery of the largest possible quantity—10 or 15,000 maunds of Cherra Poonjie coal—in Calcutta, with the least possible delay, compatible with the fair trial of the experiment. The Kasyahs, on whom the burden of the experiment will literally fall, though a fine athletic race, are little accustomed to labour; Major Lister may therefore have some difficulty at first in reconciling a sufficient number of them to a conti-

* A cargo of it having recently arrived in Calcutta, it is now (4th May, 1840) under trial on a large scale, and promises to turn out very favourably.

nued effort, the object and importance of which, they can so little understand.

It is necessary to take the quality of coal into account before any particular price per maund can be regarded as dear or cheap; it is quite incredible to what degree a slight difference in quality affects the value of coal, for steam vessels. It has been found by means of the only trial instituted between Cherra and other coals now in use, that 9 maunds are equal to 14 of Burdwan coal. Let us suppose (without laying too much stress on a single trial of a few maunds) the proportionate value of the two coals to be ascertained as above; 100 maunds of Cherra would not only as a fuel be equal to 155.5 of Burdwan, but we should also have to debit to the latter the value of 55.5 maunds stowage or tonnage, which might amount to more than the entire value of the coal consumed.

The Cherra Poonjie coal forms the cap of a hill, from which each cooly may help himself to his load almost without the aid of mining, so that the carriage, 4 annas per maund from the pit to the nearest navigable river, though high, may be said to include the expense of winning, or bringing coal to the surface. Could any of the following indications of coal lower down, towards the foot of the mountain, be found to yield good supplies, a portion, or nearly the whole of this large item of expense might be saved, viz. 1. Tipperah hills, in a small river which descends from a hill with a Musulman Doorga called Orpeen, on its summit; 2. Opposite to Jalalgur, in Lowr; 3. Patli river, and several streams descending from the Garrow mountains; 4. Near Susung; 5. On the top of one of the lower ranges at Lowr, and in the rivers of Lowr; 6. In the Dysung and its tributaries; 7. Between Pannalik and Bansekora; 8. Barachara; to which we have now added Byrung Poonjie, Chaila, and Mustuk, (vide para. 13, 14, and 15, of the present report).

The rate of boat-hire from the Sylhet district, along the verge of which the coal formation lies, to Surdah on the Ganges, one of the principal depôts for the supply of steamers, is stated by Mr. H. Inglis to be 21 rupees per 100 maunds. In regard to water conveyance, Sylhet has the advantage of any of the coal districts to the westward, while its proximity to the great rivers of Bengal gives it an advantage over the Assam coal districts; and thus while any mines that might be established in Sylhet would hardly be affected in value by similar establishments in any other part of India, there is hardly a district from Arracan to Palamow the value of whose mines would not seriously be affected by any subsequent discovery of coal in Sylhet. In like manner any collieries that might be established in

Assam, or other remote provinces, would be entirely superseded in the Bengal market by any new discoveries of good beds of coal that might be made in the Sylhet district. It is for this reason that we have laid peculiar stress on the importance of a thorough investigation of the coal measures along the base of the Kasyah and Garrow hills, since upon this, and the manner in which it is conducted, must depend in some measure the prudence of investing capital in more distant coal districts.

Surdah is within a few miles of Bogwangola, one of the greatest marts in Bengal for grains of every kind, goor, oil, ghee, and the chief articles of native consumption. Being situated in the centre of Bengal, near the junction of all the principal rivers, as the Bhaugarutty, the Ganges, and Bramputra, it is naturally the centre of internal commerce, and consequently the greatest mart for boats in Bengal. Surdah, or some situation in that neighbourhood, appears therefore to be the situation at which a General Depôt ought to be formed. We have consulted J. W. Grant, Esq. of the Civil Service, who had been long commercial resident at Maldah, and Major Carter, who has been for a large portion of his life in the Bengal Commissariat, and the experience of both these gentlemen goes to prove that at Bogwangola and Jellinghee, boats for the transmission of coal from Surdah to any part of Bengal or the Upper Provinces may be had to any amount of tonnage likely to be required.

The distance from Cherra Poonjie to Calcutta by water, is about the same as to Surdah; while the latter is one hundred and fifty miles nearer to Rajmehal, and other depôts to the eastward.

Major Carter states that the voyage from Calcutta to Cuttack in an empty boat should not take above 24 days, and returning laden, about the same period, as the stream would be favourable to Dacca, and from thence in the tide way. " Assuming however, two months as the time necessary to complete a voyage, including loading and unloading, it strikes me," says Major Carter, " 2½ annas per maund should nearly cover the carriage, and below I give the grounds of my opinion. A thousand maund boat can be hired at

per Mensem..	30	0	0
" 10 Dandies at 3 Rupees each,..............................	30	0	0
" 1 Manji at 4 Rupees,......................................	4	0	0
	64	0	0
			2
	128	0	0

This boat should carry 800 maunds, which just gives 2 annas 6½ pice per maund, so that at this rate Cherra coal ought to be delivered in Calcutta at 7 annas per maund; Major Carter therefore expresses his surprise that an offer recently made by the Marine Board, of 9 annas for Cherra coal, had not been taken up, and suggests that if boats of 2 or 3000 maunds, such as are used for bringing wood from the Sunderbunds, were employed as far as the rivers would admit, the carriage would be still lower.

The readiness with which boats may be had for any regular trade, may be imagined by the following observation of Major Carter:—" Hundreds of large boats frequent the Sunderbunds, nearly as far as Dacca, in search of cargoes of rice and dhan, the worth very little more in ordinary years than coal, and the latter scarcely one half as valuable; they do not find their cargoes at one place, or belonging to one person, but attend the banks, and purchase in whatever quantities the people bring to the market, often only a few seers, and seldom exceeding a few maunds."

The Commissariat regulations, and general custom of paying boat-hire on a computed distance instead of the time actually employed, might in the first instance militate against the economy of any arrangement for hiring boats, says Major Carter; but if a few boats were purchased or built at Dacca or in the Sunderbunds, and manned by a private individual, the result would prove the correctness of these calculations. A good boat could be built for 500 rupees, and in six trips, at the above rate, would yield 300 rupees, leaving 60 for casual repairs, this would repay itself in less than two years; but a boat is expected to last seven or eight.

Cuttack.

About ten years ago a specimen of coal found in the Cuttack district was sent to the Asiatic Society, probably with some particulars which do not appear to have been noted in the proceedings; the circumstance was however suggested to the Committee by Captain Jenkins, in 1837, and soon after Lieut. Kittoe, then with his regiment at Cuttack, obtained a specimen, together with some particulars which he communicated to the Committee; on which he was requested to visit the spot, when he collected the following particulars. Half a mile from the Fort of *Talcheer** coal seams are exposed along the banks of a small *Nulla* called *Belajooree* (at a spot where workmen employed

* Talcheer is a town on the Bramenee river, 140 miles from the coast.

by Mr. G. Becher, had a few years before extracted some specimens of coal). Mr. Kittoe formed an excavation to the depth of 15 feet, in which he found at a depth of 13 feet a bed of "good glistening coal," 1 foot to 1½ foot thick, reposing beneath ten feet of "*shingle*" and two beds of shale and blue clay, each 1½ foot thick. The latter, as well as a grey rock beneath the coal, both containing fossil plants.

Mr. Kittoe states, that a native contractor offered, in the event of coal being raised at Talcheer, to convey it down the Bramenee river to *Himsuagola*, on the coast, where large sloops may anchor, at four annas per maund; but Mr. Beetson, the contractor for the transport of salt from thence to Calcutta, was of opinion, that two annas per maund at the utmost would be sufficient. From the coast to Calcutta the transport of coal would be the same as that of salt.*

The next coal to which Mr. Kittoe by his guide was conducted, is a few miles higher up the Bramenee, and at a distance of sixteen or eighteen miles from that stream, so that its conveyance would be considerably more expensive. The coal is here exposed for a mile on either side of a nulla called *Sungurra*, a tributary of the Bramenee, averaging in height from five to fifteen feet above the sand. The country is said to be level from the coal to the bank of the Bramenee, so as to afford every facility for the construction of either a road or a canal. Iron ore is found in great abundance throughout both these coal districts, and the ore is smelted to some extent, and by the same process as that which prevails in other parts of India.

Such is the substance of Mr. Kittoe's Report.† The specimens of coal furnished were not of good quality. Three specimens of Talcheer coal examined at the Mint, afforded the following average results :—

Specific gravity, ...		1.3610
Volatile matter, ...	39 0	
Carbon, ...	44 1	
Earthy matter, ...	15 10	
	100 0	

Talcheer and Hingolar may be regarded, we think, without much doubt, as an extensive and valuable coal field. The workable beds will

* At present there are three contracts for the conveyance of salt from Hunsew to Calcutta; the rates are 18 Rs., 17 Rs. 8 annas, and 17 Rs. per 100 maunds.

† Vide Asiatic Journal of 1839, pp. 137—144.

probably be found to be some distance from the surface at the spots visited by Mr. Kittoe, but the district appears to have been subject to so much local disturbance, that more favourable positions for coal mines may be expected, when the country has been properly examined.

Since the above remarks were written, the Committee have received a communication from Mr. Mills, the Commissioner of Cuttack, enclosing a report from Mr. Beetson, whom he deputed on 22d February last, at the instigation of Mr. Smith, the President of the Coal Committee, in order to procure further information on the subject. Mr. Beetson reports, that " the samples laid before the Committee by Lieut. Kittoe, were far inferior to those I have now brought with me. The latter are equal to the best Burdwan; but to satisfy the Committee as to its description and quality, if Government will pay the expenses, which will amount to a mere trifle, I shall be happy to undertake the delivery of one or two hundred maunds in Calcutta by next December." Mr. Mills observes that the specimens, as far as he and other gentlemen at the station are able to judge, are so very good, that he authorized Mr. Beetson to procure 100 maunds for trial in Calcutta. This coal is derived from the second, or more distant coal field visited by Mr. Kittoe. The locality in which the coal occurs is, according to Mr. Beetson, called *Gopal Pushad*, and the nulla by which it is laid bare, *Sangra*, which corresponds with Mr. Kittoe's name *Sungurra*. Mr. Beetson states, that the distance from Gopal Pushad to Talcheergur is from fourteen to sixteen miles, and recommends that the coal be carted by buffaloes (the common draught cattle of the country) to Talcheergur. From Talcheer the coal could then be conveyed in ten or twelve maund boats to Kumalung, six miles below Talcheergur, where it should remain till the setting in of the rains, and from thence it may be conveyed for six months of the year in from 100 to 300 maund boats to Hunsuah on the coast, where it would be available for sea-going steamers at from three to four annas per maund. From Hunsuah, Mr. Beetson would undertake to convey the coal to Calcutta at 18 Rupees per 100 maunds, and indeed he thinks he could supply it to the Calcutta market at six annas per maund, including every expense.

Adji.

Since our last report, little has been elicited regarding the northern boundary of the Burdwan coal field, where the beds advance towards the Adji river. Mr. Erskine in reply to a circular from the Committee, dated October, 1838, recapitulates the different places at which coal has been found. Mammudpore is the most eastern situa-

tion. The pits are here four or five miles from Seedporeghat. The mineral is better to the westward at Parihorpore, about ten or twelve miles above Seedpore. Seedpore is eighteen miles from Cutwa or Culna on the Hooghly, and the river is pretty open during the rains for boats of 400 maunds burden from Maulyghat to Cutwa, a distance of forty miles. The upper portion of the river rises and falls suddenly, so as to render it difficult to manage a larger boat than 200 maunds. Mr. Erskine observes, that considering the difficulty of the Adji navigation, and the scarcity of boats at present, and also the high price that it would be necessary to offer to boatmen to induce them at first to undertake the carriage of coals; he does not think the coal could be delivered at Cutwa under four annas per maund. Should the regularity of the employment induce people to build more boats (as has been the case on the Damooda,) prices might fall to about 3 annas per maund. Adji coals are now used for the Dhoba Sugar Works to the extent of 10 or 15,000 maunds per annum.

Rajmahal.

When our last report was written, coal was known to exist in two situations only in the Rajmahal hills; namely, Sicrigully and Hurrah. In April 1838, Major Forbes was informed by Mr. James Pontet that he had found a bed of coal in the Rajmahal hills, on the banks of a nulla called the Bramenee, sixteen miles distant from the water carriage during the rains, about thirty miles west of Moorshedabad, and nearly in the line of the canal proposed by Major Forbes. A specimen of this coal afforded the following on analysis:—

Specific gravity, ...		1.370
Volatile matter, ...	42 0	
Carbon, ...	44 8	
Earthy matter, ...	13 2	
	100	

A sample consisting of a few maunds furnished by Mr. Pontet sometime before to Mr. Scott, the commander of the Jumna steam vessel, also proved of favourable quality. Mr. Pontet having been desirous of procuring the means of extending his observation, these were provided, and on the 20th June he dispatched ten bags of coal to Calcutta, this also proved favourable; but a subsequent dispatch of 400 maunds consisted of shale and inferior coal. In explanation of this last unfortunate circumstance, Mr. Pontet stated that the necessary aid did not reach him till the rains had set in, when the place being unhealthy,

he was obliged to leave the raising and dispatch of the coal to inexperienced natives.

The following is an extract from Mr. Pontet's letter, in which he describes the operations in which he was engaged—" After the first vein of coal, we came upon a hard black stone, and finding the operation of boring through it so very tedious, I took upon myself to select a spot for a shaft, and procured well-diggers, and stone-cutters, who have been for the last two months at work, at present to all appearance with satisfactory prospects, as one of the stone-cutters who opened a shaft at Burdwan says this mine bears some resemblance to it. I am induced to persevere a few feet more, in hopes of coming to a useful vein. The first twenty-three feet of soil is red and black earth mixed with kunkur, and under that, to a depth of forty feet, are thirteen different *strata*, three of coal, and the rest various kinds of stone." Mr. Pontet transmitted to the Committee specimens of all the different beds passed through, which are remarkably characteristic of the true coal measures; and of eleven different beds passed through in the last seventeen feet of the excavation, three were coal of good quality, but too thin for working, and in the shale we observed excellent specimens of *Vertabrea Indica*, one of the few abundant fossils of the Burdwan beds that happens to have received a name.

The excavation was formed on the N. W. side of the Bramenee nulla; but Mr. Pontet states that he traced the coal a mile S. W. of the Bramenee river, from which he concludes that the Burdwan and Rajmahal beds are connected

Soan River.

In a letter from Mr. Ravenshaw, Officiating Commissioner of Patna, to the Government of Bengal, dated 6th January last, that gentleman states that a Cazee had found a bed of coal at a place called Chupree, four miles from the Soan, near its junction with the Koila, and estimated the expense of delivering coal from this bed to Dinapore to be five and a half annas per maund. On this information 300 rupees were advanced to the Cazee to enable him to commence operations; but after extracting 100 maunds, precisely similar to Palamow coal, the bed assumed a slaty character, and the Cazee abandoned his operations. If the Cazee's statement regarding the existence of coal so near the Soan be correct, the circumstances under which it occurs ought to be fully investigated.

Palamow.

Mr. Tytler, an engineer employed under the Controller of Steamers, having been deputed, under the authority of the Marine Board, to Palamow, describes a bed of coal six feet thick, exposed to a great extent on the banks of the Amanath river, where Mr. Homfray a short time before could only find a 3½ feet bed, so interrupted by ravines as to render the field very limited. There is however evidence enough in the reports of Major Sage, and Mr. Tytler, as well as in the information furnished to Mr. Ravenshaw, the Commissioner of Patna, to show that coal is here abundant enough, the only doubt is as to its quality. The samples of Palamow coal that we have seen have been vitiated by the inexperience of the miners with an intermixture of shale, so as to render them unfit for trial. Major Sage, Executive Engineer, Dinapore, states that he had formerly been in the habit of receiving supplies of coal from Palamow, which he considered a good and useful fuel. We have no doubt that a good coal may be procurable in Palamow, but such samples as have been hitherto sent to Calcutta for trial have been inferior, partly no doubt from their having been ill chosen from the numerous beds that seem to occur in that district. Major Sage found the following results from comparative experiments instituted between Palamow and Burdwan coal, from which it would appear that the former has the advantage in point of quality.

	Palamow.	*Burdwan.*
Coke,	46 2	46 2
Volatile matter,	47 0	40 0
Earthy matter,	6 8	13 8
	100 0	100 0

In experiments of this kind on a small scale, every thing depends on the specimens selected for comparison. The Burdwan coal varies in quality in different mines, just as Palamow coal would vary if mines were once fairly established in that district.

The best Burdwan coal we can induce the contractor who supplies the laboratory of the Honorable Company's Dispensary to furnish, affords 25 per cent. of ashes, but the kind used on board steamers is said to be very superior to this, and the Ranygunge variety with which other coals are compared, is the best in Burdwan. Much judgment is therefore necessary in selecting samples for trial from new coal districts, when the object is to compare them with Burdwan coal. Whatever

coal it has been customary to use will always have the advantage of a new coal in such trials, in as much as the form of the furnace, and the manner of keeping up the supply will be such as are suited to the old coal, while the necessary experience is wanting with regard to the most favourable circumstances for burning the new.

If the draught of the furnace be too great for the coal, the fire will burn down too rapidly, and the coal will be wasted in an unnecessary quantity; and if not sufficient, the fire will burn too slowly, and the stoaker perhaps accustomed to throw in fresh fuel at certain intervals will keep the fire choked, so as to require more frequent stoaking than necessary, and (as Colonel Presgrave remarked on the late trial of Palamow coal) every time the door is opened for this purpose, a volume of cold air enters, the effect of which is to lower the steam.

On board the Jumna steamer, 13th March last, three samples of Palamow coal were tried, one furnished to Mr. Ravenshaw by Cazee Mohumdee, mixed however with Chupree coal, and the other two from Mr. Tytler; the first seemed to answer best, though evidently raised without judgment, and mixed with shale. The faults of this compared with the best Burdwan coal were, that it required a much larger quantity to keep up steam, and that it ran into slags or clinkers, which choked the bars of the furnace. This last effect may have been owing to the coal being mixed,* and perhaps would not have taken place had the bars of the furnace been wider apart. Mr. Tytler's sample from Lower Miral appeared to burn very freely, but compared with the best Burdwan coal, twice the quantity was required to keep up steam. On a third sample from Upper Miral being tried, it was found that even with an excessive consumption of the fuel, it could not keep the engine at full work. The value of these experiments will however depend on two circumstances, namely, whether the samples tried were the best that could be chosen, and whether the furnaces of the Jumna are as well suited to the nature of the coal as any that could be constructed.

Mr. Ravenshaw thinks he can procure a contract for the supply of Palamow coal at Dinapore for six annas per maund, it would therefore be of some importance to have the question of its quality fairly set at rest.

* A small quantity of carbonate of lime or soda would have the effect of rendering the earthy parts of coal fusible. We think in another trial of Mr. Ravenshaw's mixed coal we could easily select the pieces which formed slags from the general mass, as they are covered on the surface with an efflorescence of soda. We think they belong to Singra one of the Palamow beds, and the peculiarity is probably very local.

Assam.

A report having been furnished on the subject of the Assam coal beds since the last general reports of the Committee were written,* there is little to say on the subject. Lieut. Brodie, principal assistant to the Commissioner, found coal of good quality about a year ago in a very favourable position on the Disung river, a specimen of which was forwarded to the Committee in July last, and found to afford—

Specific gravity, ...	1.3
Inflammable matter, ...	40
Carbon, ...	55
Earthy matter, ...	5
	100

We believe the Assam Tea Company are already about to open a colliery in this situation, with the intention of keeping a depôt supplied from it at Dikoo Mookh, on the main river.

Mr. Brodie had before found two and a half feet bed of coal about three and a quarter of a mile above the falls of the Jumna. A boat on average would reach the falls from Gowahattee in twenty days, and return in ten. Some years ago coal was raised by Mr. Bruce, under orders of the late Mr. Scott, from beds near the banks of the *Suffry*, a tributary of the Disung; on trial *this proved to be the best coal ever found in India*, but the situation was inconvenient, the Suffry being unnavigable at all seasons, and a small ridge of hills would render the formation of a hackery road difficult. In February 1838, Captain Jenkins found two beds of coal, one of them 100 yards in length, and eight feet in thickness, projecting from the banks of the Disung river about a mile above the village of Boorhath; the other situated in rising ground, about a quarter of a mile from the first, was exposed for 200 yards in length, and numerous small springs of petroleum emerged from beneath it. From these Captain Jenkins' servants collected about five seers of petroleum in a few minutes. The Disung is navigable for six months of the year.

Beds of coal were also observed by Captain Jenkins at Jeypoor, about ten miles east of Boorhath, on the Bora Dihing river, a quantity of which was raised by Captain Hannay and sent to Calcutta, but not approved of. Like all similar experiments on the quality of coal the results proved little, especially as we now understand the Assam Tea

* Published in Journal As. Soc. 1838, pp. 948, 959.

Company have established a colliery in this situation,* in addition to the one already alluded to on the Disung; thus two principal depôts will be supplied on the main river at Debru and Dikoo, from distinct coal districts capable, if necessary, of supplying other depôts along the whole line of the Bramaputra.

An excellent coal was found by Lieut. Bigg and Mr. Griffith on the Numroop river, in Upper Assam, and Mr. Bigg states that immediately opposite the village on the west of the river is another range of hills similar to those in which the coal is found; in these they found eight or ten springs of petroleum.

Nerbudda.

With regard to the Nerbudda coal, the Committee have received no communications since their last reports were laid before Government, but it appears to have been since tried at Bombay, and found to be of very excellent quality.

Specimens of coal were found by Captain Burnes during his mission to Cabul in 1838, in the following districts, viz., 1. Shukurdura, near Kala Bagh, where it occurs in a hill two miles south of the village, and other situations in the neighbourhood; distance from the Indus about 15 miles. 2, near Muckud, locality doubtful. 3, fifteen miles SSE. of Cabul near Moozye, in the vicinity of copper mines. 4, Jamoo, in the Punjab, near the Chenab, where it would be as valuable as if found on the Indus. 5, between Tak on Kaneegoorum, NW. of Dera Imael Khan, 1½ coss East of the small village of Sungarkhyle, in the neighbourhood of the Indus, where the country is said to be poor, and labour cheap. Captain Wade, Political Agent at Lodiana, also found specimens of coal in the Maundi Hills north of the Sutlej: more recently we believe Mr. W. Jameson, whose observations will be of peculiar value in every point of view, has found extensive tracts belonging to the coal formation, approaching as near to the Indus as he had been able at the time he wrote to carry his inquiries.—*Journal of the Asiatic Society of Bengal*, No. xcviii—1840.—pp. 198—214.

(*Signed*) J. M'CLELLAND,
Assistant Surgeon,
Secretary Coal Committee.

4*th April*, 1840.

* As well another at the place.

XIV.—NOTICES OF BOOKS

1.—*Illustrations of Indian Botany; or, figures illustrative of each of the Natural Orders of Indian Plants, described in the Author's Prodromus Floræ Peninsulæ Indiæ Orientalis.—By* ROBERT WIGHT, M. D., F. L. S., *&c. Surgeon on the Madras Establishment.—Madras, Published by* J. B. PHAROAH, *for the Author:*—Quarto pp. 218. vol. 1st.

2.—*Icones Plantarum Indiæ Orientalis, or Figures of Indian Plants.—By* ROBERT WIGHT, M. D., F. L. S., &c. *Surgeon on the Madras Establishment.—Madras, Published by* J. B. PHAROAH, *for the Author:*—Nos. 1 to 16, vol. 1st.

The first volume of that excellent and highly useful work, the *Illustrations* of Indian Botany, is completed with the 13th number. In the prosecution of his plan the indefatigable and talented author has illustrated sixty-two of the Natural Orders. The descriptive accounts of the botanical relations, economical uses and medicinal properties of the plants, with descriptions of recently discovered and imperfectly known species, are ample, and are of the highest practical value and importance, to the physician, to the agriculturist, and to commercial men, as well as affording, aided by the *Icones*, to the Systematic Botanist all that he desires in illustration of the Flora of the extensive and interesting region of Peninsular India.

The pictorial illustrations of the 1st volume amount to 100 in number; they are lithographs, executed at Madras, in a style highly creditable to the state of the arts in India; and coloured, under the author's eye, by native artists.

The *Icones* may be considered, in the author's language, a *pictorial index* to the *Prodromus Floræ Peninsulæ Indiæ Orientalis.* They are uncoloured outlines of all the species which Dr. WIGHT's own collection enables him to give drawings of, or copies from ROXBURGH's and other expensive and little known works.

These two works, then, it will be seen, are unparalleled in the history of scientific publication for comprehensiveness and utility.

With the 13th number of the *Illustrations* are published a *Dedication* to the Right Honorable JOHN *Lord* ELPHINSTONE, Governor of Madras; a *Preface* and *Introduction;* with an *Index,* &c. to complete the volume. From the *Preface* and *Introduction* we shall borrow largely, as they tend to exemplify the scope and objects of the author's works now under review, as well as to develope the progress and present state of botanical science. From the body of the work it is of

little use to commence extraction, for we should be tempted to go on until we had transferred the whole to our pages. The object of this notice is to do all in our power for the extension of the study of Botany through the assistance of Dr. Wight's admirable publications, of which we confidently anticipate an extended circulation; for we are grieved and astonished to find from the author's preface that it needs a "continuation of support from the public, without which it is impossible his contracted means can bring it to a close, as it has already involved an outlay so much beyond its returns, that, but for the liberal aid of Government, in patronizing it and its fellow, the *Icones*, to the extent of fifty copies each, both must long ago have ceased to exist."

"In the Preface to the Prodromus Floræ Peninsulæ Indiæ Orientalis, will be found a brief historical sketch of the rise, progress and present state of Indian Botany. From that sketch it will be perceived that, until the publication of that volume, every work since the time of Linnæus, with the excepton of DeCandolle's *Systema Vegetabilium* and *Prodromus Systematis*, treating of Indian plants, was arranged according to the Linnæan sexual or artificial system. It has naturally followed that nearly all those who had devoted their leisure to the investigation of Indian plants have adopted that system, and find the study of them according to their natural affinities often exceedingly difficult, if not actually irksome, even though the advantages of the latter over the former method so greatly preponderate as scarcely to admit of any comparison being instituted between the two. Instigated, therefore, partly by a long cherished wish to promote the extension of Botanical pursuits by diffusing a knowledge of species, partly by the desire of lessening to others the difficulties which beset my own path when passing from the one method of study to the other; but principally in the hope of being able to show that, for the attainment of a correct and comprehensive knowledge of the properties and uses of plants, whether as food, medicine, or in the arts, a much more direct and certain method is, through an enlarged and philosopical acquaintance with their natural affinities, than by the most laborious, but empirical search for individual properties, when entered upon without any such guide as the knowledge of affinities supplies to our researches. To elucidate these affinities, and at the same time to furnish the Indian Botanist with the means of identifying species, this work and its companion, the "Figures of Indian Plants," were undertaken, and, even at their present early stage, the author has reason to believe with much advantage towards the accomplishment of this design.

"According to the natural arrangement, all plants, whether of a province, a kingdom, or of the whole world, agreeing in certain ascertained peculiarities of structure, taken not from one set of organs only, but from every part of the plant, commencing with the root and ascending to the perfect seed, are grouped together as one order or family, under a name derived either from a prominent genus of the group or from some striking peculiarity of the order (*Ranunculaceae* from Ranunculus,: *Cruciferae* from their cruciate flowers: *Leguminosae* from the leguminous fruit, &c.). Such groups, if correctly associated according to their affinities, that is organic structure and physiological peculiarities, would, it was presumed, be found to participate in the kind and qualities of secreted products which result from the operations of organic life.

"In this anticipation the philosophical investigator of nature has not been disappointed; for, so constantly does the fact agree with the theory, it is now known, except in rare instances, plants referable to different families will not graft on each other, apparently because the juices elaborated in different families of plants, though growing side by side, in the same soil, are so different in their qualities, that those of the one are unfit to nourish a branch taken from the other: while, on the other hand, two plants of the same natural family, however much the soils in which they respectively grow may differ, can generally be readily grafted on each other. From the same cause, the action, namely, of organization on secretion, we find, in a great many instances, identical properties common to whole families of plants. Acrimony predominates throughout the *Ranunculaceae* and *Cruciferae:* narcotism is the characteristic of *Papaveraceae* and *Solanaceae: Apocyneae* are generally poisonous, and some of the species most virulently so: astringency is common to nearly all the arboreous *Mimoseae* as well as to many of the *Caesalpineae,* it equally predominates in *Terminaliae,* and the whole of the genus *Quercus* is pre-eminently marked by that property. The *Cucurbitaceae, Convolvulaceae* and *Euphorbiaceae* are equally distinguished by properties the very reverse, the action of many species of each of these orders being violently drastic. The fruit of *Rosaceae* and seed of *Leguminosae,* on the contrary, are so universally wholesome, that it may be laid down as a general rule, almost without exception, that they may be safely partaken of whenever they are met with.

"These few examples will suffice to show how vastly the study of properties is facilitated by an acquaintance with natural affinities, and will I trust, at the same time serve to remove an objection which I have more than once heard urged against this work, that it did not sufficiently,

treat of Medical Botany. This objection could only be raised by those who did not sufficiently consider that its object was to establish principles on a scientific basis, as being the true way to attain the object sought for. There is no royal road to science, and until the medical man studies the principles of Botany as a science, he need never expect, through an inspection of plates or specimens of medical plants, to become a medical Botanist. But with only an elementary knowledge of Botany, such, for example, as a perfect knowledge of the structure of the flower and fruit, an acquisition not generally of very difficult attainment, the case is widely altered; since any one who had advanced so far in the knowledge of the elements of the science may easily make himself master of the characters of a few species of an order, and then he can generally trace its relations with nearly allied orders, or even recognize some of them from family likeness alone. Having ascertained the order of the plant under examination, the subsequent steps leading to the attainment of a comprehensive knowledge of its name, history and properties, are comparatively easy; and not of it only, but of the whole order. It is true, that to acquire a thorough acquaintance with an order, frequently requires the student to examine and carefully compare several, but every plant so examined facilitates subsequent researches, and lessens the difficulty of the next step, that, namely, of making out the genus. But even without going so far, having once determined the order of a plant, we are in possession of a fund of information; since but little further trouble is required to make ourselves acquainted with all that is yet recorded respecting that order, and to ascertain whether any applications we have learned are still unknown to science. The natural method, in short, gives both precision and extension to any enquiries we may undertake respecting plants, whether considered with reference to organic structure and its modifications, the products of organic life in connection with structure, or the applications of these products to the comforts and conveniences of life; and thereby to the advancement of civilization among men. The difficulties to be surmounted at the outset of the study are no doubt often great; those, namely, of determining the order of a plant when it departs from the normal structure of the order to which it belongs: but even then, a futile search is not unattended with advantage, as the examination puts us in possession of much useful information, which will materially assist our future research, should we be necessitated to turn to the artificial system to find its name.

" Should we, on the contrary, commence our examination with the artificial sexual system, the first step, that of determining the class and

order of a plant, is the easiest; but, that done, it often happens that nothing is learned: for, should the specimen under examination have a stamen or style more or less than the regular number, and nothing is more common among tropical plants, we look in vain in the class or order, where, according to our specimen, it should be found; and, when found, still that system conveys no collateral information regarding the relations of the plant, or of the nature of the properties with which it may be endowed.

"In drawing these comparisons, it is not my wish unduly to exalt the one at the expense of the other, for in truth they are so very different that it is impossible to compare them; they both have their advantages and disadvantages, and, in the present state of the science, are both necessary: I certainly think, however, the preponderance of good is greatly in favour of the natural method. In thus giving the preference to that system which enables the student, who has made considerable progress in its study, to look over a large collection of plants, not one of which he had ever seen before, and readily refer probably as many as 19 out of every 20 to its proper natural order, from family likeness alone, I am far from as yet wishing to see the other altogether exploded, since by it we are often enabled quickly to determine abnormal plants that we could not so easily have done by the other; and, in such cases, I still occasionally find the advantage of having formerly become familiar with the Linnæan system. Though to this extent I approve of it, I could not recommend it for general use, as its natural tendency is to contract our ideas, by concentrating our attention too exclusively on one set of organs, and confining our enquiries to the investigation of the names of species only, in place of, as is the case with the other, expanding them with the growth of our knowledge, by extending our researches, from the examination of species, to the investigation of masses in all their bearings.

"While for these cogent reasons, we are, in the present advanced state of the science, gradually permitting that once celebrated system to drop into oblivion, we must not forget how much Botany is indebted to it for its present advancement. The extent of these obligations can only be justly appreciated by comparing the botanical works of its great author with those of his immediate predecessors, not one of the plants described by whom can now be made out from their descriptions, unaided by some collateral circumstance, or by plates, and too often, even with these aids, they are still unknown. Immediately on its introduction into practice, order supplanted disorder, arrangement and method succeeded and dispersed the previous confusion and perplexity, as light

disperses the darkness. From this hour materials accumulated with unprecedented rapidity, and have continued to do so to such an extent, that the catalogue of known plants which, on the most liberal computation, did not, at Linnæus' death, exceed 12,000, is now but little if at all short of 100,000 species. To this increase the natural method owes much of its present admirable precision, as, without such a mass of materials, innumerable breaks in the chain of affinities must still have existed, marring both its beauty and usefulness. We may thence I think fairly conclude, that the sexual system of Botany, however defective in scientific precision and comprehensiveness of design, was yet of incalculable benefit to the science; the impulse which its beauty and simplicity communicated, calling thousands of enthusiastic votaries into the field, by whose joint labours was collected the vast mass of valuable materials of which the more philosophical natural method was constructed: leaving altogether out of consideration, the justly admired nomenclature and precision of language appropriated to the description of plants introduced by its author—the universally acknowledged father of modern Botany—Linnæus.

"Having I trust satisfactorily shown that the essential difference between the two systems lies in the tendency of the one to contract our ideas, by attaching an undue value to the knowledge of species, while that of the other is to elevate and expand the mind by imparting a knowledge of and leading to the contemplation of masses, I believe I have said all that can be required in support of my preference of the natural system, and of the propriety of my first determination to publish a flora of this portion of India arranged according to that method. The same reasoning equally establishes the propriety of my entering on the present work, explanatory of the principles of that system, and showing its application to the grouping in masses of the knowledge which has for ages been accumulating as detached observations; but which, until thus concentrated, was of difficult access, and, when obtained, only applicable to the species to which it originally appertained, in place of, as now, by affording so many points of comparison, or known quantities, enabling us to deduce useful applications of hitherto unknown plants, simply on the ground of their structural relationship or affinity in the system of nature to others, the qualities of which are well known.

"That many anomalies, nay positive contradictions, occur in our present groups, is undeniable; but it is equally certain that many of these are disappearing under the more rigid scrutiny of structural peculiarities, which have often shown, that the most striking departures from the general rule, were attributable, not to imperfections of the rule itself,

but to erroneous associations of plants, either only remotely or not at all allied, in the same groups.

"The objects of this work may now be briefly summed up: they are, first, to explain the principles of grouping plants according to their natural affinities, and illustrating these by figures of species appertaining to each group: and, secondly, to show, by adducing a variety of examples of the fact, that, in a great majority of instances, similarity of structure, or botanical relationship, is accompanied with similarity of properties; and, lastly, to prove that these premises lead to the inference, that, having ascertained by careful examination and comparison its nearest botanical relatives, the properties of which are known, we are often enabled to infer the properties of an imperfectly known plant. In addition to these more immediate objects, I have endeavoured to render it a supplement to our Prodromus, by a running commentary on that work, and by the description of such new species as have come into my possession since its publication. To render the information thus embodied in these pages as easily accessible as possible, I have added a very copious index, including every name and noting every page where it occurs. By this means any one is enabled, with little trouble, to trace a family through all the relations, whether botanical, economical or medical, in which it occurs in these pages."

Introduction.—"It is laid down as an axiom by some eminent modern Botanists, 'that nature only creates species, and knows nothing of a natural system of Botany.' This, it is added, is entirely a human contrivance, founded on a consideration of the resemblances existing between the parts, properties and qualities of plants, according to which their affinities are determined, and species, having the greatest degree of relationship in all these particulars, are placed next each other, in such a way, that the qualities or intimate structure of an imperfectly known plant, may be inferred from a careful consideration of the known qualities and structure of those nearest to which its botanical characters would place it, in a system constructed on these principles. Whether or not this theory be just, I will not stop to enquire, for, so long as the object is obtained, I feel quite satisfied that the method by which we attain it, whether a mere human contrivance or the work of nature herself, is so infinitely superior in its fitness for the supply of human wants, and for furnishing matter for philosophical enquiry, to all the artificial ones that have gone before, that there can be no hesitation as to the propriety of its instant adoption, whatever may be the difficulties to be, in the

first instance, surmounted in acquiring a knowledge of its principles. These, in the present instance, are not by any means so great as they have been represented; for, as Jussieu well observes, whatever trouble is experienced in remembering or applying the characters of natural orders, is more than compensated by the facility of determining genera, the characters of which are simple in proportion as those of orders are difficult. The reverse takes place in arbitrary arrangements, where the distinction of classes and sections are simple and easy to remember, while those of the genera are in proportion numerous and complicated. On this question, therefore, as there can scarcely be two opinions, it now only remains for me very briefly to explain the principles of the arrangement or distribution of the orders, adopted both in this work and in our Prodromus.

" The arrangement followed is very nearly that of Jussieu, as modified by DeCandolle, and adopted in his Systema and Prodromus. According to this system, all plants are first distributed under two principal classes, CELLULAR and VASCULAR, the former comprehending all the plants destitute of spiral vessels and of Cotyledons—CELLULARES; the latter, including all the flowering plants which are furnished with both these organs—VASCULARES. The vascular plants, of which only we have as yet treated, are again divided into two classes—DICOTYLEDONS or EXOGENOUS plants, and MONOCOTYLEDONS or ENDOGENOUS plants. To the former, all trees and shrubs which increase in thickness from the centre towards the circumference by a succession of concentric layers of wood, belong, as well as nearly all those herbaceous annuals, the leaves of which have reticulated or anastomosing vessels. To the latter the various kinds of grasses, Lilies, Orchidiæ, Palms, Plantains, &c. belong; the vessels of the leaves of which pass either in straight lines from the base to the apex, or from the midril to the margin, and the leaves are sheathing, in place of being attached by a joint to the stem. These distinctions are not without exceptions; but the exceptions are so few as scarcely, in practice, to affect the value of the rule. These primary divisions, though thus based on the most obscure and difficult portions of vegetation to investigate, the minute structure of the seed and organization of the stem, are, in fact, the easiest, generally speaking, of determination; the simple circumstance of a plant having a flower, proving that it has spiral vessels, while the practised eye of a botanist can, almost invariably, tell at a glance, by merely inspecting the distribution of the vessels of leaves and structure of the stem, whether the seed is mono: or dicotyledonous. Having, by this summary process, decided to which division of the system a plant belongs, we proceed

with our investigation. Let us suppose the plant is dicotyledonous, and that we still follow DeCandolle as our guide.

"He divides *Dicotyledonous* or *Exogenous* plants into four sub-classes, the characters of which are taken from the fructification. These four are respectively named *Thalamifloræ*, *Calicifloræ*, *Corollifloræ* and *Monochlamydeæ*.

I. "*Thalamifloræ* are distinguished by having several distinct petals and stamens inserted on the Thalamus or receptacle of the flower, and not cohering with the calyx.—(flowers hypogynous).

"The petals and stamens do, however, occasionally cohere; as, for example, in *Malvaceæ*, so as in some degree to resemble those of the third class, *Corolliflorae*, from which, however, in all such cases, their numerous, nearly distinct, carpels distinguish them.

II. "*Calyciflorae* have also several petals, either distinct or united to each other, but inserted along with the stamens on the calyx, usually through the medium of a disk lining its tube or concave portion.—(flowers pyrigynous or epigynous).

III. "*Corollifloræ* have the petals united into one, bearing the stamens, and inserted on the thalamus, or receptacle (hypogynous).

IV. "*Monochlamydeæ* have either no corolla, or the petals, if present, are united to the calyx, forming together a single, not double, perigonium or verticel of flower leaves round the pistil.

Before going further it may be proper to observe, that this is a mere artificial classification, intended simply to facilitate the arrangement of the orders in a linear series, and to aid in enabling us to determine to what part of that series we ought to turn to find the order of any plant under investigation. While it pretty well fulfills these objects, it must be acknowledged, that, like all such artificial combinations, it is liable, on the one hand, to produce unnatural associations; and, on the other, to separate orders most nearly allied; besides presenting examples of monochlamydeous and dichlamydeous genera in the same order. These objections, however, apply to the arrangement, only, of the orders, not to the orders themselves, which may, though individually perfectly natural, be most unnaturally placed in relation to each other; a defect, to which all systems yet proposed are more or less liable, and, we may almost assume, ever will be, when we take into consideration that families of plants, like provinces of a kingdom, touch each other, not by one point only, but on all sides, and that we might as well expect to arrange the latter in a correct, linear series, as the equally irregularly formed and closely surrounded provinces, that is the natural orders, of

the vegetable kingdom. All, therefore, that can be looked for, are well constructed and correctly defined orders or provinces, the boundaries of which should be as clearly marked out as the nature of the subjects will permit. Then comes the arrangement of these, in such a manner as to facilitate reference, or, to follow out the simile of kingdoms and provinces, to teach under what latitude and longitude we must look, first for the province (the natural order), and then for the town (the genus), to which the subject of our enquiry (the species) belongs. Various plans have been tried for the attainment of this desideratum, but no one seems yet to have obtained such general favour as the one the ground work of which I have sketched, even though liable to such striking defects as those I have indicated. But to proceed.

I. " THALAMIFLORÆ.—This sub-class includes all the plants originally referred by Jussieu to his 13th class (Polypetalæ hypogenæ), those, namely, with hypogynous or inferior flowers, and several petals; or which has more recently received the name of Hypopetalæ, that is, petals inferior to the pistil or ovary. This is a large class, presenting many anomalies; but, upon the whole, generally of sufficiently easy application in practice.

II. " CALYCIFLORÆ.—This sub-class is more difficult, and often not easily distinguished from either the preceding or the succeeding one. It is divided into six sections.

1. " *Peripetalæ*, with several distinct petals inserted on the calyx towards its base, leaving the ovary superior or free—*Leguminosæ*, the section *Potentilleæ* of *Rosaceæ*, and *Salicarieæ*, all afford easily understood examples of this section.

2. " *Epipetalæ.*—In this section the tube of the calyx is prolonged and lined by the torus, which forms a small disk on the summit of the ovary, and the ovary is enclosed by and coheres with the calyx tube: the distinct petals and stamens are inserted on the outside of the disk. The ovary is here said to be inferior or adherent, and the flower superior. *Roseæ*, *Pomeæ* and *Combretaceæ*, apparently afford examples of this section, but want the disk on the summit of the ovary. *Umbelliferæ*, *Araliaceæ* and *Corneæ*, are the only orders referred here as being truly epipetalous.

3. " *Epicorallæ Corisantheræ;* this section differs from the last in having the petals united, forming a monopetalous corolla, bearing the stamens inserted on its tube, and the anthers not cohering round the style. The common honey-suckle is a familiar example of this section; to which also the elder, the coffee, valerian, &c., that is the orders *Caprifoliaceæ*, *Rubiaceæ*, *Valerianeæ*, &c. belong.

4. " *Epicorollæ Synantheræ;* the essential distinction between this and the preceding section consists in the anthers of this cohering by their edges, forming a tube round the style; and from the succeeding, by the corolla being inserted on the top of the ovary, not on the bottom or tube of the calyx.

5. " To this section the vast order *Compositœ* alone belongs; as examples of which it may suffice to mention the humble Daisy, the common Thistle, the Artichoke, the Dandelion, and gaudy Dalia, to enable every one to understand what is meant by a compound flower, the general flower of each of these being made up of a congeries of small ones.

6. " *Pericorollae;* in this, as in the two preceding sections, the petals are united into a monopetalous corolla, but in place of being inserted on the top of the ovary, it is inserted on the tube, or towards the base of the calyx; leaving the ovary either partially or altogether free.

" The Lobelia, the Hairbell, and Heath tribes, afford examples of this last section of the 2d class.

III. " Corolliforæ.—This sub-class differs from the three last sections of the preceding, in the insertion of the corolla only: like them the corolla is monopetalous, bearing the stamens; but, in place of being inserted on the calyx (perigynous), springs from the receptacle or base of the flower, inferior to the ovary (hypogynous): hence, in the language of Jussieu, the section is now named *Hypocorollae* (see table below).

" The Jasmines and Convolvulus afford the most familiar examples of this class, but the Gentians, Trumpet flowers (Bignonia), Heliotropes, Verbenas, Solanums (Brinjal, Potatoe, &c.) all belong to it.

IV. " Monochlamydeæ.—This sub-class is characterized by having a single perianth, that is, only one verticel or whorl of floral envelopes, or if two are at any time present, the petals adhere to the calyx. It is divided into four sections.

1. " *Hypostamineae;* here the stamens are inserted on the receptacle, and the ovary is free, even though concealed within the tube of the calyx, to which it does not adhere. The Marvel of Peru *(Mirabilis Jalapa)*, so much prized as a garden ornament, and the Amaranthus, appertain to this section. The flower of the former, often so delicately variegated, is in truth only a petaloid expansion of the calyx, and not a corolla, in the glabose inflated bottom of which, the filaments and ovary are found perfectly free. This lower portion of the calyx afterwards forms the black shell-like covering of the seed.

2. " *Peristamineae;* in this the stamens are inserted on the calyx, not hypogynous. *Chenopodium, Polygonum,* and the beautiful *Begonia,* are examples of this section.

3. " *Epistamineae;* here the ovarium is inferior, cohering with the tube of the calyx; stamens, inserted on the limb, or superior. *Santalum album* (Sandal-wood), and *Aristolochia* (Birthwort or snake-root) are well known examples of this section.

4. " *Diclines;* flowers unisexual or without a perianth. To this tribe are referred *Euphorbiaceæ, Urtiaceæ, Piperaceæ,* besides the Oak, Alder, Birch, Willow, Pine, Walnut, &c. Judging from the dissimilarity of the plants associated under this name, bearing in mind, at the same time, that several other orders in which diclinous flowers predominate are scattered through the system, it is to be hoped future researches will tend to break up this class, and, by the removal of some of the orders, will establish a more natural distribution of the remainder: some of those now placed here seem to have been referred to it, as to a lumber room, from not knowing where to dispose of them to greater advantage.

" For the remaining portion of the system *Monocotyledons* and *Acotyledons,* I shall refer for the present to the subjoined tables: the first exhibiting a *Clavis* of the system of Jussieu, the next, that system as modified by De Candolle, and adopted in our Prodromus.

I.—COTYLEDONS none.

Class 1. *Acotyledones.*

II.—MONOCOTYLEDONES.

2. *Monohypogynæ,* stamens hypogynous.
3. *Monoperigynæ,* stamens perigynous.
4. *Monoepigynæ,* stamens epigynous.

III.—DICOTYLEDONES.

§ 1. Apetalæ.

5. *Epistamineæ,* stamens epigynous.
6. *Peristamineæ,* stamens perigynous.
7. *Hypostamineæ,* stamens hypogynous.

§ 2. Monopetalæ.

8. *Hypocorollæ,* corolla hypogynous.
9. *Pericorollæ,* corolla perigynous.

10. *Epicorollæ synantheræ*, corolla epigynous, anthers united.
11. *Epicorollæ corisantheræ*, corolla epigynous, anthers free.

§ 3. Polypetalæ.

12. *Epipetalæ*, stamens epigynous.
13. *Peripetalæ*, stamens perigynous.
14. *Hypopetalæ*, stamens hypogynous.

§ . Diclines.

15. *Diclines*, flowers unisexual, or without a perianth.

A. DICOTYLEDONES, *Jussieu.*—Exogenæ, *De C.*

I.—THALMIFLORÆ, *De C.*—Cl. 1. Hypopetalæ, *Juss.*

II.—CALYCIFLORÆ, *De C.*

Cl. 2. Peripetalæ, *Juss.*
3. Epipetalæ, *Juss.*
4. Epicorollæ corisantheræ, *Juss.*
5. Epicorollæ synantheræ, *Juss.*
6. Pericorollæ, *Juss.*

III.—COROLLIFLORÆ, *De C.*—Cl. 7. Hypocorollæ, *Juss.*

IV.—MONOCHLAMYDEÆ, *De C.*

Cl. 8. Hypostamineæ, *Juss.*
9. Peristamineæ, *Juss.*
10. Epistamineæ, *Juss.*
11. Diclines, *Juss.* { § 1. Angiospermæ. § 2. Gymnospermæ. }

B. MONOCOTYLEDONES, *Juss.*—Endogenæ Phanerogamæ, *De C.*

Cl. 12. Monoepigyneæ, *Juss.*
13. Monoperigynæ, *Juss.*
14. Monohypogynæ, *Juss.*

C. Cl. 15. ACOTYLEDONES, *Juss.*

§ 1. Ductulosæ, *Arn.*—Endogenæ Cryptogamæ, *De C.*
§ 2. Eductulosæ, *Arn.*—Cellulares, *De C.*

" Of this system I have only further to observe, that the three primary divisions, Acotyledons, Monocotyledons, and Dicotyledons, are strictly natural, and must always be retained in every botanical system professing to arrange plants according to their affinities. So much cannot be said for the classes; they rest, with one exception, on a single point of structure, not in itself invariable, in the respective classes; the insertion, namely, of the stamens and petals, whether hypogynous or perigynous, points not always determinable without the aid of analogy. The secondary divisions, according to which the classes are grouped under four sections, are still more artificial and more liable to vary, and thence so much the less to be depended upon. Though to this extent artificial, this method of arranging the almost innumerable forms met with in the vegetable kingdom is, beyond comparison, superior to all that went before it; and though the classes, in which the orders are grouped, be somewhat arbitrary, they are yet so convenient, and generally so easily distinguishable in practice, as to leave little room to doubt that the arrangement, as a whole, owes much of its celebrity, and its recent almost universal adoption, to that very blemish. Various attempts have, however, been made to remove that imperfection from this justly admired system, but, so far as I am able to judge, all only serve to show, that, had Jussieu adopted any such arrangement, in place of his own, in the first instance, there is much reason to believe the sexual system, with all its imperfections, would still have reigned paramount in Botany.

" 'Jussieu originally prefixed no names to his classes, and the want of this was much objected to. Those which we have given have been lately proposed by Antoine L. de Jussieu in the *Dictionnaire des Sciences Naturelles;* and, although not entirely in unison with the principles of the Greek language, may be adopted as extremely useful, each being so framed as to suggest the structure of the class. Thus the commencement *Mono*, indicates the Monocotyledones. *Epistamineæ*, &c. having in no part any allusion to a corolla, suggests its absence. *Hypocorollæ*, and the others, allude to the corolla being of one piece, and not of distinct petals, which last is pointed out by names, *Epipetalae*, &c. The other parts of the names, *epi* (upon), *peri* (around), and *hypo* (under), need no farther explanation.

" 'While engaged in the study of plants alone, it is obviously of little consequence whether we begin, as Jussieu did, by the Acotyledones, or by the Dicotyledones; but, if we view botany as a science that treats of only one of the great kingdoms of nature, and wish to introduce it into a *Systema Naturæ*, we must bring those portions of each

most closely together which are most nearly linked. So that if we commence by Zoology, we must first describe the Mammalia, and end by those of a simple structure; and then take up the most allied of the Acotyledones, and follow the steps of Jussieu. But, if we describe vegetables in the first place, we must begin with the Dicotyledones, and finish with the Acotyledones. When, however, a *Systema vegetabilium* is contemplated without reference to animals, it may perhaps smooth the way to the student if it commence by those more obvious, and, though of more complex formation, yet more simple to be comprehended. On this account DeCandolle has reversed the arrangement of Jussieu.' (Article Botany Encly. Brit. 7th Ed. by Dr. Arnott)."

III.—*Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere.* —*By* J. Forbes Royle, m. d., v. p. r. s., *Late of the Medical Staff of the Bengal Army, &c. &c. &c.*

In former numbers of this Journal we have rendered the deserved meed of praise to previously published parts of this splendid and highly interesting work. It is now concluded, by the publication of the 11th or supplementary number (just received in India); which, besides the termination of the botanical illustrations, forming, of course, the bulk of the work, includes short treatises on the following subjects:—1st. *On the Geology of the Himalayan Mountains,* by Professor Royle;—2d. *On the Meteorology of the Plains* and *Mountains of N. W. India,* by the same;—3d. *On the Entomology of the Himalayas and of India,* by the Rev. F. W. Hope, f. r. s., f. l. s., &c., President of the Entomological Society of London;—4th. *Memoir on the Mammalogy of the Himalayas,* by Wm. Ogilby Esq. m. a. &c. &c., Secretary to the Zoological Society of London;—5th. *List of Birds in Dr. Royle's Collection.* The two first of these we have transferred to the pages of our present number, and we are sure we cannot more effectually subserve the cause of Science, than by republishing the whole of these valuable treatises, which will, through the medium of this Journal, penetrate into remote parts of India, where the extremely valuable original work, owing to its bulk and costliness, may never reach.

XV.—*Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, 11*th June* 1840.—*Colonel* W. MONTEITH, K. L. S. *in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

Choix De Contes et Nouvelles traduits du Chinois par Théodore Pavie—By the Translator.

Calcutta Journal of Natural History, No. 1—By the Editor.

The following communication to the Society, was laid before the meeting:—

Continuation of the Catalogue of the birds of Southern India.—By T. C. Jerdon, Esq.—Tribes *Tenuirostres* and *Fissirostres.*

(Published in our present number.)

Thursday Evening, 2*d July* 1840.—A. D. CAMPBELL, ESQ. *President of the Committee of Papers, in the Chair.*

The following works, presented to the Society, were laid on the table, and thanks voted to the donors:—

A Guide to Chemical Testing and Analysis.—By LIEUT. BRADDOCK.

Transactions of the Royal Medico-Botanical Society of London, vol. 1, part 4.—By the Medico-Botanical Society.

Journal of the Royal Geographical Society of London, vol. 9, part 3. —By the Royal Geographical Society.

Journal of the Asiatic Society of Bengal, No. 96, December 1839.—By the Asiatic Society.

Read a letter from the Secretary to the Geological Society of London, dated 7th November 1839—expressing the Society's thanks for the donation of the Madras Society's Journal.

Read a letter from the Secretary to the London Linnean Society, dated 5th November 1839—returning the Society's thanks for Nos. 13 to 22, both inclusive of the Society's Journal.

Read a letter from the Secretary to the British Museum, dated 13th January 1840—acknowledging the receipt of the Society's Journal, Nos. 22 and 23, and returning thanks for the same.

The following communications to the Society were presented:—

A note by Colonel Cullen on the carboniferous deposits on the Malabar Coast.

(Published with Mr. Newbold's Paper in the present No.)

A specimen of Coal from Mergui on the Tenasserim Coast was presented from the same gentleman, with the following account of the locality whence it was derived.

Extract from a letter addressed to Government, on 9th December 1839.

I have the honour to state, for the information of His Honour in Council, that during the past month, I personally visited the site of the last discovered coal-field, on the banks of the Tenasserim river, and the results of my observations on the spot, are, that there can be no doubt we shall eventually succeed in procuring the present limited quantity of 50,000 maunds of coal, at an expense not exceeding five annas per maund—that a portion only (say 10,000 maunds) of this quantity can be brought down during the present fine season, and that the larger the quantity required to be supplied, the less will be its prime cost in depôt. The coal is found at the distance of about half a mile from the bank of the river. The intermediate space is a level, and as excellent timber abounds in the neighbourhood, there will be no difficulty in constructing a tram-road for the conveyance of the coal to the river. It is a curious circumstance that the spot where the coal was discovered, and has been dug out in small quantities by the natives, appears to be the summit of an upheaving. The spot in question is the bed of a small winding nullah, not exceeding thirty feet in width, and in the winding or small reach where the coal was first discovered, it is found by digging to the depth of a few feet only, across half the width of the nullah, while the other half has none. About the centre of the nullah it commences and appears to dip towards the S. W. (the right side of the nullah at this spot) at an angle of about thirty or thirty-five degrees, while the line of the bed itself, which I may call the line of greatest height, appears to run about N. E. but to what extent is as yet wholly unknown. A section of the right bank of the nullah discovers:

1st.—Soil to the depth of about eighteen feet.

2d.—Slate to the depth of five feet, under which is found the coal, said by those who have dug there (I was unable to test the accuracy of this assertion) to extend to a depth of ten feet, when a layer of mud of three or four feet is found, and, below that again, coal. It appeared to me that the best plan of operations would be to turn the course of the nullah (a work of no difficulty), and to take the old bed of it, at the place hitherto worked, as a kind of shaft, from whence the coal might be followed in its dip; but I have left the plan of operations entirely to Lieut. Hutchinson, from whose peculiar qualifications in work requiring mechanical skill, I feel confident the best result may be anticipated.

It is obvious from the above brief description of the nature of the coal bed, that some considerable preliminary operations are necessary, ere the coal can be worked to any extent, but I imagine there are few localities in any part of the world, presenting similar facilities. When once a clearing has been made of the nature of a shaft, from whence galleries may be carried, following the dip of the coal, and a tram-road formed for conveying it to the river, it is evident that the more coal taken out, the less will be its prime cost in the depôt of Mergui, and the only question is, what is likely to be the expense of the preliminary operations. Assisted as Lieut. Hutchinson will be by gangs of convicts, I feel confident that by the month of March, or April next, he will have every thing in train for putting coal on board the rafts, or barges provided for it, at an expenditure considerably under 8,000 rupees. When all his arrangements are thus complete, it will not matter how large the quantity of coal required may be, as the additional expense involved in procuring large quantities will be insignificant.

Extract from a letter to my address from Lieut. Hutchinson, *Superintendent of the Coal Mine.*

The reach of the nullah, in which the formation chiefly shews itself, and where some tons of coal have been dug out by the natives, runs in N. N. E. direction.

Near the south extremity of the eastern bank, the upper stratum of coal shews itself above the bed of the nullah, covered by five feet of clay-slate, six feet of iron clay, and about six feet of gravel, sand, and vegetable soil; dipping at an angle of 30° towards the N. E. There is a dislocation of the strata at this point, the whole formation sinking abruptly, two feet below the nullah bed, upon which level it extends 200 yards towards the north-west; how much farther I cannot at present say. The first stratum of coal in the horizontal bed, lies from

fifteen to thirty feet below the surface, and has been ascertained to extend ten feet in the thickness.

I have therefore determined upon sinking a shaft in this place (about fifty yards from the nullah), and, if no unfavourable circumstances occur, commencing to work the mine from this point.

(True extract)
(Signed) E. A. Blundell, *Commissr. in the T. P.*

(True copies)
(Signed) Henry Jas. Nicholls.
S. A. C. G. Tenasserim Provinces.

The thanks of the Society were voted to Colonel Cullen for the above communication.

Mr. Braddock submitted an account of his analysis of the supposed fossil from Hingolee.

NOTE,

By Walter Elliot, *Esq. on the species of Naja described in the last Number of this Journal.*

Since the notice of the Serpent exhibited at the Meeting of the Society on the 13th January last, I have received the Journal of the Zoological Society for 1838, in which, it appears that at the sitting of the 12th June, Dr. Cantor read the following notice of a new Genus proposed by him, to which the reptile figured in the last No. of the Journal appears to be referrible. It will be observed that Dr. Cantor at first considered the species described by him in the Asiatic Researches, as a Naia.

" The venomous serpent, to which I shall here call attention, is the type of a new genus; which, from its inhabiting hollow trees and frequenting the branches, I propose to call Hamadryas. Its characters induce me to assign it a place between the genera Naja, Laurenti, and Bungarus, Daudin, which two forms it will be found to connect together.

" In consequence of the strong resemblance in the general appearance between the Naja and the Hamadryas, when first my attention became attracted to the latter, I thought I could refer this serpent to that genus; and it was not until I was able to examine a specimen whose poison-fangs were untouched (those of the first specimens I saw having been drawn by the natives who are greatly afraid of this serpent) that I discovered the maxillary teeth behind the poison-fangs.

HAMADRYAS, (Cantor.)

" *Generic Character.—Head* broad, subovate, deplanate, with a short obtuse rostrum, covered above with fifteen *scuta*. *Cheeks* tumid. *Eyes* large, prominent, pupil round. *Nostrils* widely opened within the confine of two *scuta*. *Gape* very ample, subundulated. *Poison-fangs* anterior, behind which are the maxillary teeth. *Neck* dilatable. *Body* thick, smooth, imbricated with smooth scales disposed in oblique rows. *Tail* short, covered with *scuta* and *scutella*, its apex acute. (Cantor.)

" Example.—*Hamadryas ophiophagus.* (Cantor.)

" *Description.*—Above olive-green, girt with black sagittal striæ, abdomen glaucous, marbled with black. The Hindustanee name is *Sunkr-Choar.*

" *Locality.*—Bengal.

" The Hamadryas, like the Bungarus, Hydrus, and Hydrophis, has a few maxillary teeth behind the poison-fangs, and thus like the latter connects the venomous serpents with isolated poison-fangs to the harmless, which possess a complete row of maxillary teeth. Of the terrestrial venomous serpents the Bungarus is chiefly characterized by a distribution of the teeth similar to that of the Hamadryas, which, also partaking of the chief characteristic of the genus Naja, viz. that of forming a hood or disc, constitutes an immediate link between the genera Bungarus and Naja.

" Hamadryas ophiophagus differs from the Naja tripudians:

1. By its maxillary teeth.
2. By the strongly developed spines on the os occipitale inferius.
3. By the integuments covering the head.
4. By the integuments covering the abdominal surface of the tail.
5. By its colour.
6. By its size.

" According to the natives the Hamadryas feeds chiefly upon other serpents; in one I dissected I found remains of a good sized Monitor, which fact may account for its arboreal habits, as I have in Bengal, along the banks of the rivers, observed numbers of those large lizards among the branches of trees watching for birds.

" The power of abstaining from food, generally speaking, so characteristic of the serpents, is but in comparatively small degree possessed by this species; the most protracted starvation amounts to a period of about a month, while the Vipera elegans, the Naja tripudians, and the Bungarus annularis, have, without inconvenience, been confined in

cages without any food for more than ten months. Two specimens of the Hamadryas in my possession were regularly fed by giving them a serpent, no matter whether venemous or not, every fortnight. As soon as this food is brought near, the serpent begins to hiss loudly, and expanding the hood rises two or three feet, and retaining this attitude as if to take a sure aim, watching the movements of the prey, darts upon it in the same manner as the Naja tripudians does. When the victim is killed by poison, and by degrees swallowed, the act is followed by a lethargic state, lasting for about twelve hours. Such of the other Indian venomous serpents, the habits of which I have had opportunity to study from life, show themselves much inclined to avoid other serpents, however ready they are to attack men or animals, when provoked or driven by hunger; and I am not aware of any other of those serpents being recorded as preying upon its own kind. A short time ago, however, during my sojourn at the Cape of Good Hope, I received from high authority the following fact, which throws a light upon the habits of the Naja of Southern Africa, one of which, when being captured, threw up the body of a Vipera arietans (Vip. Brachyurus, Cuvier) which bore marks of having been submitted to the process of digestion.

"The Hamadryas, like the greater number of Indian serpents, evinces a great partiality to water; with the exception of the tree-serpents (Leptophina, Bell) they all not only drink, but also moisten the tongue, which, as this organ is not situated immediately in the cavity of the mouth, become in the serpents two different acts. Specimens of this serpent in my possession changed the skin every third or fourth month, a process which takes place in all the Indian serpents several times during the year. The Hamadryas is very fierce, and is always ready not only to attack but to pursue when opposed; while the Cophias, the Vipera, the Naja, and the Bungarus, merely defend themselves, which done, they always retreat, provided no further provocation is offered. The natives of India assert, that individuals are found upwards of twelve feet in length, a statement probably not exaggerated, as I have myself seen specimens from eight to ten feet in length, and from six to eight inches in circumference. I have often heard it asserted, that 'Cobras' (which name is naturally enough given to every hooded serpent) have been met with of an enormous size, but I strongly doubt their belonging to the genus Naja: among a considerable number which have come under my observation, I never saw any exceeding five to six feet in length, while the common size is about four feet. Some time before I discovered the Hamadryas, I was favoured by

J. W. Grant, Esq. of the Honourable Company's Service, with an interesting description of a gigantic hooded serpent he had observed in the upper provinces, and which, he remarked, was not a Naja. By inspection this gentleman denied the Hamadryas to be identical with the above mentioned.

"The natives describe another hooded serpent, which is said to attain a much larger size than the Hamadryas, and which, to conclude from the vernacular name 'Mony Choar,' is perhaps another nearly allied species.

"The fresh poison of the Hamadryas is a pellucid, tasteless fluid, in consistence like a thin solution of gum arabic in water; it reddens slightly litmus paper, which is also the case with the fresh poison of the Cophias viridis, Vipera elegans, Naja tripudians, Bungarus annularis and Bung. cœruleus; when kept for some time it acts much stronger upon litmus, but after being kept it loses considerably if not entirely its deleterious effects.

"From a series of experiments upon living animals, the effects of this poison come nearest to those produced by that of the Naja tripudians, although it appears to act less quickly. The shortest period within which this poison proved fatal to a fowl, was fourteen minutes; whilst a dog expired in two hours eighteen minutes after being bitten. It should however be observed, that the experiments were made during the cold season of the year."

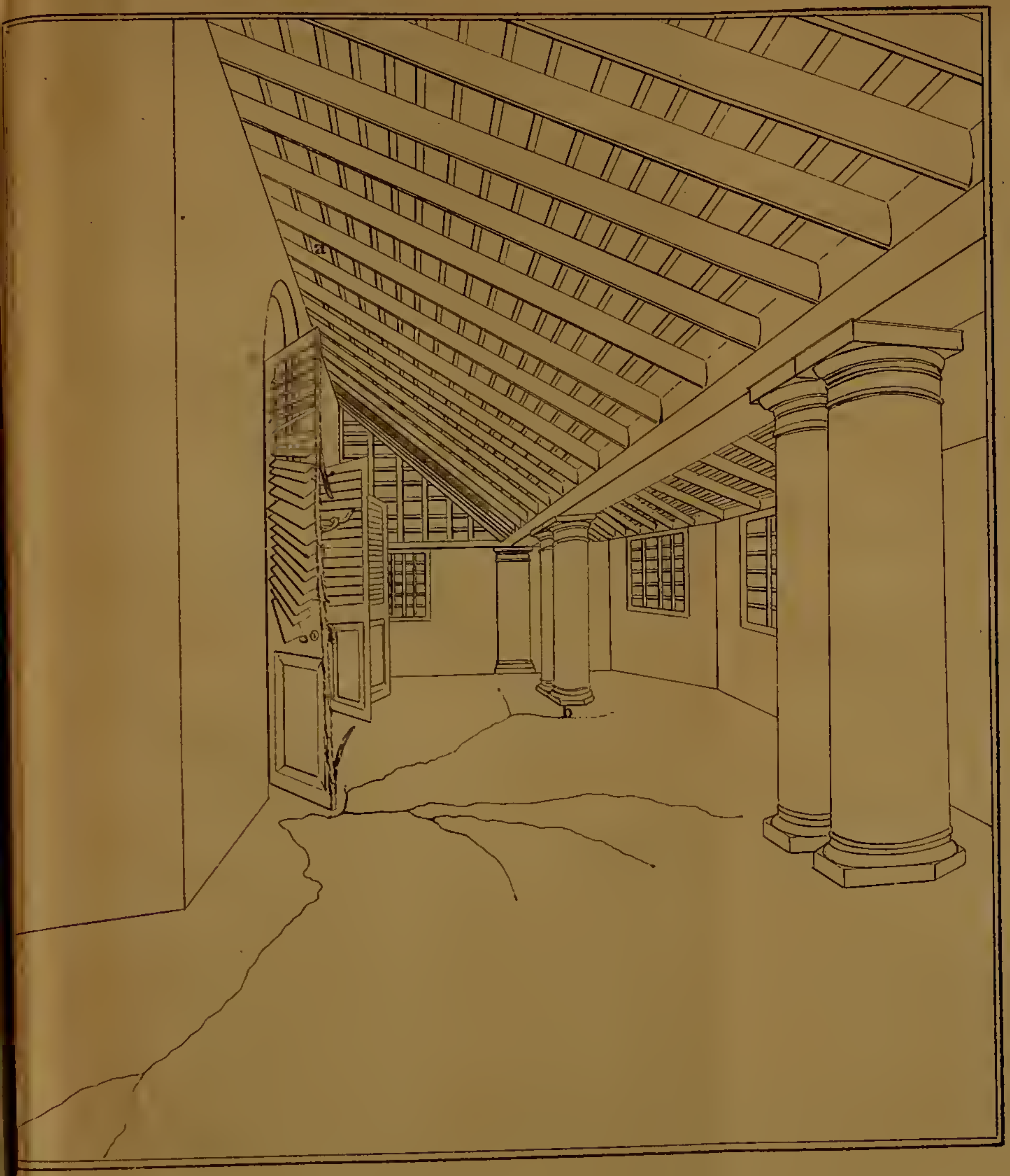
XVI.—*Meteorology.*

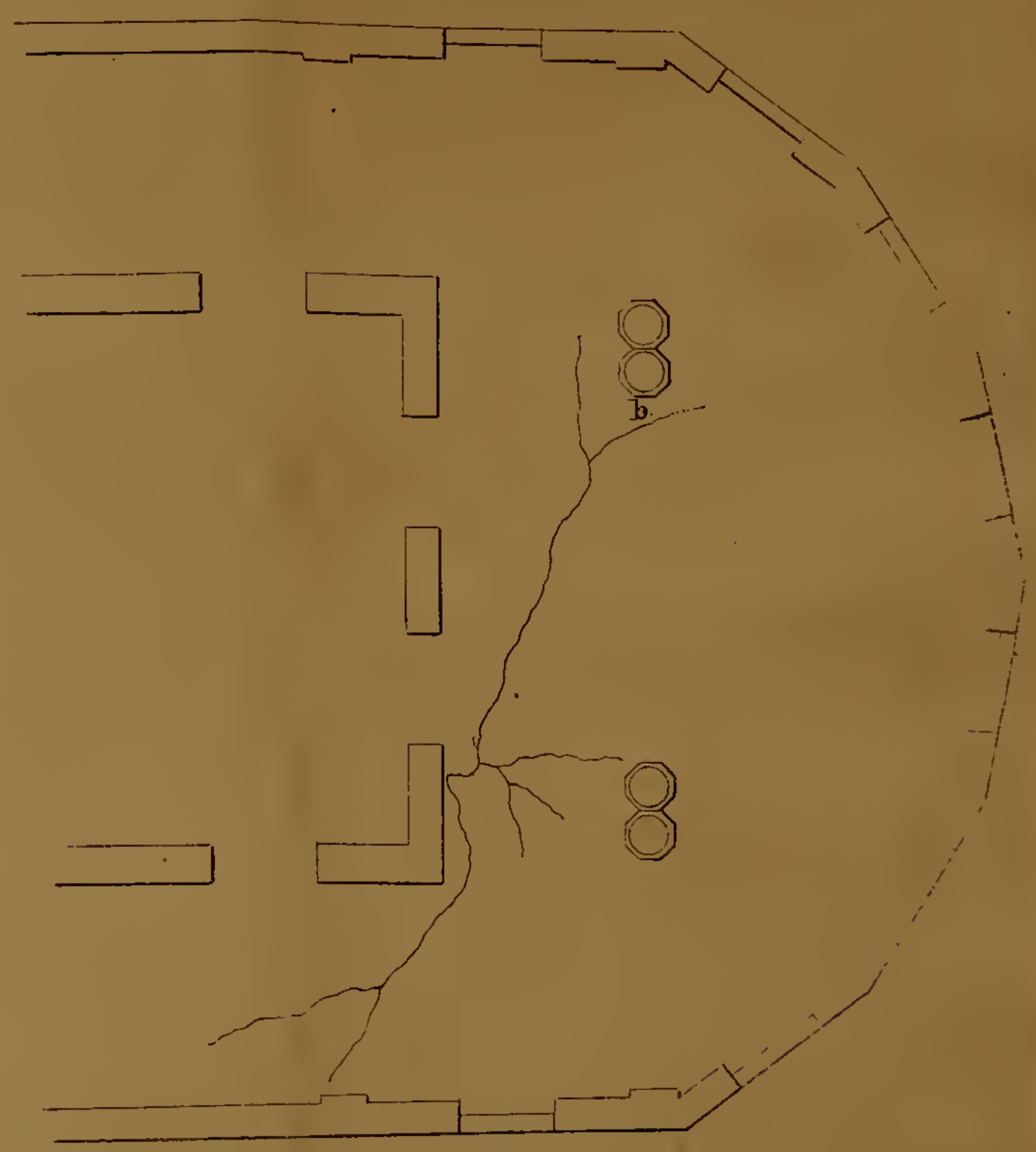
Account of the progress of the Electric fluid which struck the house belonging to Colonel Monteith, *situated on the Hill at Palaveram, on the* 1*st November*, 1839.—*By* T. G. Taylor, Esq. *H. E. I. C. Astronomer.*

Having been invited to inspect the bungalow belonging to Colonel Monteith upon the hill at Palaveram immediately after it was struck by lightning (on the 1st November last), I have thought that an account and sketch of the progress of the electric fluid, might prove as interesting to others as the inspection did to myself. The hill in question is the lowest of the two which immediately overlook the cantonment of Palaveram, and from a single barometrical measurement, would appear to be elevated 340 feet above the cantonment, and 395 feet

above the level of the sea—the other hill being about 110 feet higher: the wind which was strong and came in sudden gusts—as well as the clouds—blew from the N.E., and thunder and lightning were continuous during the evening. "At 10 minutes past 10 P. M." Colonel Monteith states, "a sharp clap of thunder, something like the report of a gun, took place close to the window, and was succeeded at the same moment by a second report *in the room*, which was instantly filled with dust;" this second report Colonel Monteith remarks "I thought at first proceeded from a loaded musket having been fired by the electric fluid"—there was a musket in the adjoining verandah—"at the same time I felt a strong shock over the fore part of the feet, and numbness, extending to the knees, which immediately went off." Colonel Monteith's impression was, that the electric fluid had entered the room through the venetians in the eastern verandah, and passing through the room, had made its exit through the venetians on the western side of the bungalow; but a careful inspection shewed, that it had struck the roof of the bungalow, which is sloping, at about ten feet below the apex, where it broke two or three tiles and proceeded through to the rafters; here refusing the conducting powers of the rafters, it descended nearly perpendicularly through a space of five feet, to a vertical iron bolt, through which it passed quietly, until arriving at the wood work of the door, which it shivered to pieces, and eventually, after passing through the rattan mat, it left a blackened impression of its force upon the chunam. Chunam being a very imperfect conductor of electricity, and hempen twine being a very good one, I should have expected that the twine-lacing of the rattan mats (which covered the whole of the floor of the bungalow), would have been selected by the electric fluid to convey its superabundant excess to the earth, but the case was otherwise; for, although twenty or thirty pieces of twine must have been all but in contact with the electric fluid, still it was evident that not one of these had enacted the part of a conductor.

The first impression on the floor, was exhibited by a dark patch nearly circular, and about an inch in diameter; from hence it separated into three main channels, each of which after pursuing a meandering course, and throwing off two or three branches, eventually stopped short as exhibited in the drawing. I noticed as curious in the terminations of these streams, that four out of the seven exhibited at their termination a circular spot, somewhat larger than the diameter of the stream itself; two others were dissipated without any mark, and that which passed under Colonel Monteith's feet (apparently the weakest of the whole) terminated in a broad splash.





References

a. *Place where the Electric Fluid entered.*
b. *The spot where Colonel Monteith was standing when the explosion took place.*

Black lines on the floor under the mats, about 1 inch broad and decreasing to the extremities ending in a small circle.

BRITISH MUSEUM

Horary Meteorological Observations made agreeably with the suggestions of Sir John Herschel.

1*st.—At the Madras Observatory on the* 21*st March* 1840.

1840.	Time.	Barometer.	Thermometer. Dry.	Thermometer. Wet.	Direction of wind.	Strength of wind.	Remarks.
Mar. 21	6 A. M.	30,052	74,8	1,3	s w	1	Clear, gentle wind.
	7	30,066	75,9	1,4	s w	1	Do. do.
	8	30,082	79,6	3,1	s w	1	Do. do.
	9	30,098	82,8	5,8	s w	2,3	Do. strong wind.
	10	30,102	85,9	8,9	s	2,3	Do. do.
	11	30,080	88,2	12,7	s w	3	Do. do.
	12	30,038	91,9	17,3	s s w	3	Do. do.
	1 P. M.	30,000	91,8	13,9	s w	2,3	Do. do.
	2	29,982	87,9	10,4	s	3	Do. do.
	3	29,956	86,3	9,3	s E	3	Do. do.
	4	29,960	84,6	7,1	s E	3	Do.
	5	29,952	83,8	6,0	s E	3	Do. along-shore wind.
	6	29,962	82,7	5,2	s by E	2	Do.
	7	29,974	81,8	4,3	s s E	2	Do.
	8	29,988	81,6	3,9	s E	2	Do.
	9	30,018	81,4	3,4	s E	2	Do. strong wind.
	10	30,022	80,0	2,2	s E	2,3	Do. do.
	11	30,014	80,0	2,5	s E	2,3	Do. do.
	12	30,004	79,8	2,3	s E	2,3	Do. do.
	1 A. M.	29,998	78,0	1,1	s	1	Do. fresh wind.
	2	29,986	77,5	1,1	s	1	Flying clouds do. dew.
	3	29,980	76,7	0,2	s	0	Do. calm do.
	4	29,998	75,7	0,4	Calm.	0	Do. do. do.
	5	29,998	75,5	0,5	—	0	Clear do. do.
22	6	30,016	75,7	0,7	s w	1	Flying clouds, gentle breeze.
	7	30,030	76,9	0,7	s w	1	Clear do.
	8	30,056	80,3	2,4	s w	1	Flying clouds, do. wind.
	9	30,088	82,4	4,0	s w	2	Do. strong wind.
	10	30,096	86,3	9,8	s	2	Do. do.
	11	30,096	86,1	8,5	s E	3	Do. do.
	12	30,050	87,1	8,6	s E	3	Clear do.
	1 P. M.	30,032	87,3	8,9	s E	3	Do. do.
	2	30,000	87,4	10,0	s E	3	Do. do.
	3	29,986	86,7	9,0	s by E	2	Do. along-shore wind.
	4	29,970	86,0	8,0	do.	2	Do. do.
	5	29,978	84,0	5,6	s E	2	Do. fresh wind.
	6	29,980	82,0	4,0	s E	2	Do. do.

2d.—At the Trevandrum Observatory at the Vernal Equinox 1840.

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
Mar. 21	6 A.M.	29.699	76.0	2.9	71.82		,,		Cumuli about the hor.—rest clear [calm.
	7	.728	76.5	2.9	72.34	N. E.	1	2.5	Do. do. wind just perceptible
	8	.745	81.0	5.4	73.38	do.	2	7.0	Do. do. do.
	9	.757	84.0	6.4	75.12	do.	,,	5.3	Do. do. calm.
	10	.755	87.2	11.2	71.25	S. W	1	cly.	Cloudy light air.
	11	.743	88.8	10.9	73.55	do.	6	do.	Do. pleasant wind.
	Noon.	.703	89.3	11.5	73.25	do.	6	12.0	Zenith getting clear do.
	1 P.M.	.684	90.0	12.7	72.12	do.	6	13.0	Sky clear do.
	2	.647	90.0	13.1	71.46	do.	7	9.0	Do. do.
	3	.626	89.2	12.1	72.15	do.	7	8.5	Sky pretty clear do.
	4	.625	88.7	11.4	72.69	do.	5	3.0	Do. gentle wind.
	5	.635	86.7	10.9	71.12	SS. W.	4	2.0	Do. do.
	6	.643	84.7	9.6	70.94	do.	4		Do. do.
	7	.667	83.8	9.4	70.22	do.	2		Do. light air.
	8	.701	83.7	8.9	70.92	do.	,,	No observation.	Thick cumuli nearly calm.
	9	.715	83.4	7.3	73.12	do.	,,		Clearing do.
	10	.716	81.6	6.8	71.89	do.	,,		Sky clear do.
	11	.716	80.3	5.8	72.10	N.	1		Do. light air.
	Mid.	.691	78.7	4.9	71.65	NN. E.	2		Do. do.
,, 22	1 A.M.	.681	78.4	4.8	71.48	N.	1		Sky getting cloudy do.
	2	.674	77.6	4.3	71.39	do.	,,		Do. calm.
	3	.675	76.6	3.5	71.54	do.	,,		Do. do.
	4	.680	75.7	2.8	71.65	do.	,,		Sky pretty clear do.
	5	.689	75.5	3.4	70.52	do.	,,		Do. do.
	6	.702	75.0	3.2	70.30	do.	,,		Sky very clear do.
	7	.722	76.8	4.0	70.99	N. E.	1	0.5	Do. light air.
	8	.761	82.6	6.7	73.15	do.	2	3.0	Do. do.
	9	.778	85.6	9.3	72.46	do.	3	8.0	Do. gentle wind.
	10	.765	88.0	12.1	70 71	do.	3	8.5	Do. do.
	11	.737	90.6	14.0	70.67	do.	4	8.5	Do. do.
	Noon.	.695	91.7	15.8	68.89	SW. by W	6	14.0	Do. pleasant wind.
	1 P.M.	.667	91.7	15.1	70.14	do.	8	12.5	Do. brisk gale.
	2	.637	91.6	14.2	71.56	W.	10	7.0	Do. do.
	3	.628	91.0	14.2	70.82	SW. by W	6	6.0	Do. pleasant wind.
	4	.616	90.2	13.9	70.34	do.	6	2.5	Do. do.
	5	.625	88.4	10.2	73.29	do.	2	clo.	Cloudy wind just perceptible.
	6	.645	86.9	9.2	73.72	do.	2	do.	Do. do.

No Rain.

The Instruments are the same, and situated exactly as before.

G. SPERSCHNEIDER, *Superintendent.*

At the Trevandrum Observatory at the Summer Solstice 1840.

Date.	Hour.	Newman's Standard bar. corrected for temp. 32° and for capillarity.	Standard thermometer.	Depress. of wet bulb. thermometer.	Dew point.	Direction of wind.	Velocity of the wind.	Solar radiation.	Clouds, aspect of the sky and remarks.
June 21	6 A.M.	29.686	78.6	2.1	75.69				Zenith clear—rest cloudy calm.
	7	.701	80.1	2.0	77.33	W.	1		Cloudy wind hardly perceptible.
	8	.720	82.3	3.9	76.91	WN. W.	2	0.5	Light clouds wind just do.
	9	.736	83.4	5.5	75.79	W.	2	1.9	Do. do. do.
	10	.740	84.8	6.4	75.94	do.	3	7.3	Do. cumuli about horizon—gentle wind.
	11	.726	85.4	6.6	76.27	do.	3	7.8	Do. do. do.
	Noon.	.713	85.7	7.2	75.73	do.	4	6.1	Zenith clear do. do.
	1 P.M.	.695	86.8	8.2	75.44	WN. W.	5	4.6	Do. do. do.
	2	.668	86.6	8.3	75.09	do.	8	9.3	Do. do. pleasant wind.
	3	.659	86.0	7.5	75.61	do.	5	drz.	Drizzling do.
	4	.651	86.0	7.4	75.76	N. W.	5	3.0	Sky obscured with thick clouds do.
	5	.660	85.0	6.9	75.44	do.	3	0.5	Sky getting cloudy gentle wind.
	6	.671	84.0	6.4	75.12	do.	4		Overcast—at 6h. 30m. drizzling do.
	7	.679	81.5	4.4	75.39	do.	5		Clear do.
	8	.705	80.9	3.7	75.78	NW by W	5	No observation.	Zenith clear—cumuli about hor. do.
	9	.723	80.6	3.3	76.04	do.	2		Clear light air.
	10	.744	80.2	3.1	75.91	do.	4		Do. gentle wind.
	11	.734	79.8	2.7	76.13	do.	4		Do. do.
	Mid.	.726	79.6	2.5	76.14	do.	4		Sky getting cloudy—at 12h. 20m. drizzling do.
,, 22	1 A.M.	.710	79.8	2.2	76.76	W.	2		Do. light air.
	2	.691	79.5	2.2	76.46	do.	3		Sky pretty clear gentle wind.
	3	.680	78.5	2.8	74.58	do.	3		Threatening—at 2h. 20m. rain do.
	4	.672	78.4	1.9	75.77	do.	4		Zenith clear—rest cloudy do.
	5	.674	78.5	1.9	75.87	N W. by W	3		Do. do. do.
	6	.684	78.6	1.8	76.11	do.	2		Do. do. moderate breeze
	7	.703	80.2	2.4	76.88	N. W.	2	1.5	Very clear do.
	8	.708	82.1	3.8	76.84	do.	4	3.0	Cloudy—at 7h. 50m. drizz.—pl. wind.
	9	.699	83.6	5.7	75.71	WN. W.	3	6.1	Flying clouds gentle wind.
	10	.696	84.7	6.4	75.84	W.	2	5.3	Sky rather clear wind just perceptible.
	11	.678	85.3	6.2	76.73	WN. W.	4	4.8	Clear gentle wind.
	Noon.	.665	86.2	6.9	76.67	do.	6	4.3	Do. pleasant wind.
	1 P.M.	.647	87.0	7.9	76.08	N. W.	5	2.5	Zenith clear—cumuli about hor. do.
	2	.615	87.0	8.9	74.63	do.	3	3.5	Do. do. do.
	3	.598	86.5	8.4	74.84	do.	5	2.0	Sky getting cloudy do.
	4	.591	86.0	7.9	75.04	do.	6	1.4	Do. pleasant brisk gale.
	5	.599	85.0	7.0	75.30	WN. W.	7	0.3	Do. do.
	6	.611	83.5	5.9	75.32	do.	4		Do. gentle wind.

June 21st rain fell from	6 A. M. to 6 P. M.	None.
do.	6 P. M. to 6 A. M.	·0421
June 22d do.	6 A. M. to 6 P. M.	None.
	Total.	·0421

The Instruments are the same, and situated exactly as before.

G. Sperschneider, *Superintendent.*

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF JANUARY, 1840.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Strength of wind.	Direction of Wind. 10 A. M.	Direction of Wind. 4 P. M.	Direction of Wind. 10 P. M.	Cloudy Max.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.	
1840	Inch.	Inch.	Inch.	°	°	°	°	°	°			Inch.									
Jan. 1												2,096	—								
2	30,194	30,092	30,153	80,3	82,0	79,3	—	7,0	6,9	......	......	......	2,3	N E	E. S E	E	2	Fly. cl.	Clear	Clear	dew.
3	,200	,104	,200	80,3	80,0	78,5	6,8	7,7	6,0	......	......	......	2,3	N E	N E	N E	2	Fly. cl.	Clear	Clear	do.
4	,224	,119	,164	80,5	82,5	79,5	6,0	8,0	6,5	......	......	......	2,3	E	N. N E	N	2	Clear	Fl. cl.	Clear	do.
5	,174	——	,162	78,8	—	78,3	4,8	—	5,0	......	......	......	2,3	N E	——	N E	2	Fly. cl.	——	Clear	do.
6	,188	,102	,200	80,5	82,4	78,6	6,9	8,9	6,5	......	......	......	3	N E	N E	E	2	Clear	Fl. cl.	Flying clouds	do.
7	,234	,130	,216	79,6	81,0	77,2	6,6	11,5	9,7	......	......	......	3	N E	N. N E	N E	2	Fly. cl	Fly. cl.	Clear	do.
8	,220	,112	,198	77,1	82,0	76,8	11,1	—	10,3	......	......	2,818	3	N E	N E	N	2	Fly. cl.	Fly. cl.	Flying clouds	do.
9	,200	,094	,168	76,5	79,8	76,3	11,5	13,8	10,3	......	......	......	2,3	N E	E. N E	N	4	Fly. cl.	Fly. cl.	Flying clouds	——
10	,218	,125	,184	78,0	78,8	79,0	12,5	10,8	9,7	......	......	......	2,3	N E	N Ebyn	N	5	Cloudy	Cloudy	Cloudy	
11	,200	,090	,176	78,3	78,6	77,6	9,0	9,6	8,6	......	......	......	2,3	N E	E by N	N E	4	Clear	Fl. cl.	Flying clouds	dew.
12	,182	,100	,170	78,6	80,8	78,0	8,6	8,2	—	......	......	......	2,3	N E	N E	——	3	Fly. cl.	Fly. cl.	Flying clouds	do.
13	,216	,125	,192	78,2	78,0	79,2	10,0	10,3	9,8	......	......	......	2,3	N E	N. N E	N E	2	Fly. cl.	Fly. cl.	Brisk breeze	do.
14	,268	,138	,222	78,4	79,2	77,8	9,9	9,2	9,4	......	......	......	2,3	N E	E. N E	NE.byE	2	Clear	Fly. cl.	Clear	do.
15	,232	,102	,182	77,8	77,8	79,2	9,0	10,2	—	......	......	3,298	3	N E	N E	N E	2	Fly. cl.	Fly. cl.	Flying clouds	do.
16	,172	,052	,146	76,5	79,1	75,7	9,3	10,6	8,6	......	......	......	2,3	E	N E	N E	4	Ely. cl.	Fly. cl.	Flying clouds	do.
17	,174	,078	,152	76,8	79,0	74,3	9,7	12,2	6,8	......	......	......	2,3	N E	N E	N	4	Clear	Fly. cl.	Flying clouds	——
18	,200	,106	,184	77,7	79,6	72,8	10,7	8,4	5,6	......	......	......	2,3	N E	N E	N	3	Fly. cl.	Fly. cl.	Clear	dew.
19	,208	——	,186	76,8	—	73,1	5,3	—	6,0	......	......	......	2,3	N E	——	N	3	Clear	——	Clear	do.
20	,230	30,122	,200	77,3	79,5	74,2	6,7	7,7	4,1	......	......	......	2,3	N E	NE byN	N	2	Fly. cl.	Clear	Clear	do.
21	,238	,110	,182	77,0	79,4	74,4	3,8	4,8	3,6	......	......	......	2,3	N	N E	N	2	Fly. cl.	Clear	Clear	do.
22	,170	,075	,152	76,4	79,5	74,2	1,9	8,2	5,1	......	......	2,859	2,3	N E	N E	N	2	Fly. cl.	Clear	Flying clouds	do.
23	,176	,078	,154	77,0	79,3	76,2	7,4	7,5	3,7	......	......	......	2,3	E	N E	N	3	Clear	Fl. cl.	Flying clouds	do.
24	,158	,038	,088	76,9	79,8	74,3	6,9	6,0	4,3	......	......	......	2	N W	E	S	3	Clear	Clear	Clear	do.
25	,102	,010	,072	76,3	80,0	74,4	4,3	7,0	3,6	......	......	......	2	E	E	E	2	Fly. cl.	Clear	Clear	do.
26	,100	——	,116	76,5	—	73,9	4,5	—	—	......	......	......	2	S E	——	N E	3	Fly. cl.	——	Flying clouds	do.
27	,160	30,040	,130	77,9	80,0	78,3	7,1	8,3	8,3	......	......	......	2	S E	E	E	2	Fly. cl.	Fly. cl.	Clear	do.
28	,128	,022	,112	78,0	80,2	77,8	6,5	6,4	7,0	......	......	......	2	S E	E	E	2	Fly. cl.	Clear	Clear	do.
29	,154	,020	,104	78,0	80,0	75,3	6,5	8,0	6,4	......	......	2,860	2	S E	S E	E	1	Fly. cl.	Clear	Clear	do.
30	,142	,006	,088	76,8	80,1	75,9	6,2	5,1	8,1	......	......	......	2	S	S E	S E	1	Fly. cl.	Clear	Clear	do.
31	,135	——	,060	77,3	—	77,8	4,8	—	3,6	......	......	......	2	S	——	S E	2	Clear	——	Clear	do.
Mean	30,187	30,084	30.157	77,9	79,9	76,6	7,4	8,6	6,8												

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF FEBRUARY, 1840.

Days.	Barometer at 10 A. M.	Barometer at 4 P. M.	Barometer at 10 P. M.	Ther. at 10 A. M.	Ther. at 4 P. M.	Ther. at 10 P. M.	Wet Bulb. 10 A. M.	Wet Bulb. 4 P. M.	Wet Bulb. 10 P. M.	Rain. Sun-rise.	Rain. Sun-set.	Evaporation.	Strength of wind.	Direction of wind. 10 A. M.	Direction of wind. 4 P. M.	Direction of wind. 10 P. M.	Cloudy Max.	Weather. 10 A. M.	Weather. 4 P. M.	Remarks. 10 P. M.	
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o												
Feb. 1	30,120	—	30,108	77,8	—	76,3	5,3	—	6,1	......	......	......	2	S E	—	S E	1	Fl. cl.	—	Clear	dew.
2	30,146	—	30,132	76,3	—	76,3	6,3	—	5,4	......	......	......	2	N E	—	S E	1	Fl. cl.	—	Clear	do.
3	30,168	30,040	30,106	77,9	80,0	74,9	7,3	8,3	5,0	......	......	......	2	E	—	S E	1	Fl. cl.	—	Clear	do.
4	,156	,040	,106	76,9	80,4	76,6	5,2	7,9	5,6	......	......	......	2	E.	E	E	2	Fl. cl.	Clear	Flying clouds	do.
5	,150	,040	,132	78,3	80,3	74,9	5,7	8,8	5,9	......	......	2,301	2	S E	E	N E	1	Fl. cl.	Fl. cl.	Clear	do.
6	,148	,020	,066	77,5	80,6	74,3	6,6	8,1	5,4	......	......	......	2	E	E	N E	1	Fl. cl.	Clear	Clear	do.
7	,094	29,982	,058	76,5	80,6	77,3	5,5	5,9	6,5	......	......	......	2	S W	S E	E	1	Fl. cl.	Clear	Clear	do.
8	,104	30,028	,128	77,7	80,0	78,1	6,1	6,5	5,1	......	......	......	2	E	S E	E	2	Fl. cl.	Haze	Flying clouds	do.
9	,154	—	,130	79,0	—	79,2	4,5	—	5,2	......	......	......	2	E. NE	—	S E	3	Fl. cl.	—	Flying clouds	do.
10	,160	30,050	,108	79,6	80,7	74,8	7,0	6,2	3,9	......	......	......	2	E	E. S E	S E	1	Fl. cl.	Clear	Clear	do.
11	,154	,033	,102	79,7	80,7	77,7	7,1	6,2	4,5	......	......	......	2	N E	S E	N E	2,3	Fl. cl.	Fl. cl.	Flying clouds	do.
12	,126	,013	,086	79,2	80,5	78,7	6,0	6,7	4,5	......	......	2,240	2	N E	E	N E	2	Fl. cl.	Fl. cl.	Clear	do.
13	,114	29,990	,060	79,8	80,8	79,6	6,2	6,1	3,8	......	......	......	2	S E	S E	N E	3	Clear	Clear	Flying clouds	do.
14	,100	29,983	,050	79,9	81,0	79,4	5,9	6,0	4,6	......	......	......	2	S E	S E	—	2	Fl. cl.	Clear	Clear	do.
15	,100	29,986	,060	79,2	81,4	78,4	5,2	6,4	2,7	......	......	......	2	S W	S E	E	1	Clear	Clear	Quite clear	do.
16	,102	—	,088	80,0	—	75,7	7,0	—	3,4	......	......	......	2	S E	—	E	1	Clear	—	Clear	do.
17	,144	—	,078	78,3	—	77,9	6,7	—	4,7	......	......	......	2	N W	—	E	1	Clear	—	Clear	do.
18	,116	30,016	,100	78,1	81,3	74,5	4,4	6,3	2,7	......	......	......	2	N W	S E	N W	0	Clear	Clear	Clear	do.
19	,144	,025	,082	78,6	82,0	76,3	6,8	8,5	1,3	......	......	2,308	2	S W	SE. bys	S E	0	Clear	Clear	Clear	do.
20	,116	,017	,084	78,7	86,0	78,0	10,8	18,0	5,6	......	......	......	2	S W	S E	S	0	Clear	Clear	Clear	do.
21	,108	29,982	,070	79,7	86,8	77,9	15,0	15,3	6,2	......	......	......	2	S.W	S	W	0	Clear	Clear	Clear	do.
22	,116	30,018	,100	80,3	85,0	76,3	5,8	10,0	5,0	......	......	......	2	S	S	E	0	Clear	Clear	Clear	do.
23	,162	—	,082	79,8	—	79,0	3,3	—	5,1	......	......	......	2	S E	—	N E	2	Clear	—	Flying clouds	do.
24	,214	30,108	,168	80,2	82,8	77,0	5,6	7,6	2,6	......	......	......	2	E	E by S	N W	1	Fl. cl.	Clear	Clear	do.
25	,204	,100	,180	79,7	83,0	77,4	5,2	8,0	3,4	......	......	......	2	S E	E	N E	1	Clear	Clear	Clear	do.
26	—	,062	,140	—	84,3	76,4	—	9,1	3,9	......	......	2,561	2	—	S E	E	2	—	Clear	Clear	do.
27	30,158	,050	,140	82,0	82,4	78,2	7,0	6,6	5,2	......	......	......	2	S W	S. S E	E	2	Clear	Clear	Clear	do.
28	30,156	,028	,098	79,9	85,2	80,3	4,9	10,7	1,8	......	......	......	2	S E	S. S E	S	1	Clear	Clear	Clear	do.
29	,136	,023	,098	80,3	84,0	80,3	5,4	7,5	4,3	......	......	......	2	S E	S	S	1	Clear	Clear	Clear	do.
Mean	30,138	30,027	30,101	79,0	82,2	77,3	63	8,3	4,5												

METEOROLOGICAL REGISTER KEPT AT THE MADRAS OBSERVATORY; FOR THE MONTH OF MARCH, 1840.

Days.	Barometer at			Ther. at			Wet Bulb.			Rain.		Evaporation.	Strength of wind.	Direction of Wind.			Cloudy Max.	Weather.			Remarks.
	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	10 A. M.	4 P. M.	10 P. M.	Sun-rise.	Sun-set.			10 A. M.	4 P. M.	10 P. M.		10 A. M.	4 P. M.	10 P. M.	
1840	Inch.	Inch.	Inch.	o	o	o	o	o	o												
Mar. 1	30,134	—	30,124	80,0	—	79,8	6,5	—	5,0	......	......	......	2	S W	—	S	0	Clear	Clear	Clear	dew.
2	,164	30,058	,140	79,5	83,4	79,8	6,5	9,6	8,8	......	......	......	2	S E	S E	S	0	Clear	Clear	Clear	do.
3	,158	,068	,148	79,8	82,0	76,3	8,3	9,4	6,5	......	......	......	2	E	S E	W	0	Clear	Clear	Clear	do.
4	,180	,060	,132	76,0	82,3	77,2	4,3	8,8	6,7	......	......	2,491	2	S W	S E	E	1	Clear	—	Clear	do.
5	,164	,040	,112	78,6	82,6	76,9	5,9	10,3	7,3	......	......	......	2	S W	S E	E	0	Clear	Clear	Clear	do.
6	,156	,034	,128	78,6	83,5	79,7	6,6	9,0	6,8	......	......	......	2	S W	S E	S	0	Clear	Clear	Clear	do.
7	,160	,055	,124	80,0	83,0	77,8	6,0	8,0	3,2	......	......	......	2	S E	S E	S	2	Clear	Clear	Clear	do.
8	,154	—	,098	79,9	—	79,3	6,8	—	8,7	......	......	......	2	S E	—	S E	0	Clear	—	Clear	do.
9	,142	—	,092	80,3	—	80,2	8,2	—	6,5	......	......	......	2	S	—	S E	2	Clear	—	Clear	do.
10	,136	30,023	,116	80,6	84,0	78,6	6,1	9,0	5,6	......	......	......	2	S E	S E	S E	0	Clear	Clear	Clear	do.
11	,108	,020	,050	80,8	84,2	80,8	5,9	9,7	4,4	......	......	2,638	2	S	S E	E S E	1	Fl. cl.	Clear	Clear	do.
12	,112	29,988	,056	81,5	84,0	78,8	6,5	7,0	3,8	......	......	......	2	S	S E	S	0	Clear	Clear	Clear	do.
13	,102	,986	,078	81,8	83,8	80,3	4,4	5,8	4,3	......	......	......	2	S	SE. by S	S E	1	Clear	Th. hz.	Clear	do.
14	,104	,990	,050	80,5	83,8	80,8	4,8	7,3	3,4	......	......	......	2	S	S E	S E	0	Clear	Clear	Haze	do.
15	,070	—	29,088	82,4	—	81,4	7,4	—	5,9	......	......	......	2	S	—	S E	0	Clear	—	Clear	do.
16	,030	29,978	30,004	82,1	81,8	81,9	5,7	6,8	3,0	......	......	......	2	SW. W	S E	S E	1	Clear	Clear	Clear	do.
17	,068	,960	,062	82,3	86,0	81,8	5,1	7,0	3,8	......	......	......	2	S W	SE. by S	SE. by S	2	Fl. cl.	Clear	Flying clouds	do.
18	,094	,970	,062	82,0	84,0	81,5	5,8	6,5	5,0	......	......	2,421	2	S W	S E	S E	1	Clear	Clear	Clear	do.
19	,100	,968	,046	82,3	83,7	80,4	7,3	7,7	4,4	......	......	......	2	S	S	S E	1	Clear	Clear	Clear	do.
20	,090	,960	,058	83,8	84,4	81,5	7,3	5,6	4,0	......	......	......	2	S E	S E	S E	0	Clear	Clear	Clear	do.
21	,102	,960	,022	85,9	84,6	80,0	8,9	7,1	2,2	......	......	......	2.3	S	S E	S E	1	Clear	Clear	Clear	do.
22	,096	,970	,042	86,3	86,0	81,8	9,8	8,0	3,5	......	......	......	2.3	S	S E	S E	0	Fl. cl.	Clear	Clear	do.
23	,102	,968	,040	82,8	86,0	81,8	5,8	8,0	4,3	......	......	......	2.3	S	S	S	1	Fl. cl.	Clear	Clear	and along-shore wind.
24	,080	,940	,020	83,9	86,0	82,5	6,4	6,0	4,0	......	......	......	2.3	S W	S	S E	1	Fl. cl.	Clear	Clear	distant lightning NW.
25	,054	,973	,050	84,0	86,0	83,5	6,0	6,0	4,0	......	......	2,716	2.3	S E	S E	S	1	Fl. cl.	Clear	Clear	distant lightning NW.
26	,058	,960	,040	84,4	86,0	83,8	5,9	5,2	5,3	......	......	......	2.3	S E	S	S E	2	Fl. cl.	Clear	Fl. clouds	lightning to the SW.
27	,016	,916	29,988	83,0	85,8	83,0	4,7	6,8	5,0	......	......	......	2.3	E	S E	S	1	Clear	Clear	Clear	lightning to the W.
28	,005	,906	,996	86,4	86,4	83,9	7,4	6,9	3,4	......	......	......	2.3	S	S E	S	2	Clear	Clear	Clear	lightning to the W.
29	,020	—	30,030	86,0	—	83,7	7,5	—	5,7	......	......	......	2.3	S W	—	S	2	Clear	—	Clear	lightning dew.
30	,052	,980	,060	84,3	84,8	82,3	4,3	7,3	4,3	......	......	......	2.3	S E	S E	S	2	Clear	Clear	Clear	lightning do.
31	,096	,974	,062	83,4	85,8	82,5	5,4	8,8	4,5	......	......	......	2.3	S E	S E	S E	2	Clear	Clear	Clear	lightning do.
Mean	30,100	29,989	30,065	82,0	84,5	80,8	6,4	7,6	4,9												

The Instruments with which the foregoing observations are made, are placed in the Western Verandah of the Honourable Company's Observatory; at about five feet above the surface of the ground, and twenty-seven feet above the level of the Sea; the thermometer was made on purpose for the Observatory, and at 75° (the only point at which a comparison has been made) it was found to differ insensibly from the Royal Society's Standard; the barometer is one of two Standards which have been lately constructed, and may be depended upon to 0,0100 an inch.

J. Crisp, Major.
H. C. Acting Astronomer.